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ELECTRICAL REVIEW.

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THE EDUCATION AND TRAINING OF ENGINEERS.

IN our last issue we brought to a conclusion our account of the papers and the discussion accorded to them by the several sections into which the "Conference on the Education and Training of Engineers" was divided. The subject itself is without finality, just as there is no finality in engineering development. In the aggregate mass of wisdom rendered by a multitude of counsellors there must be difference of opinion. Prof. Barr's plea for a wide latitude in the systems of training is one which we must not lose sight of in these days of standardisation. "Let it not be forgotten," said Prof. Barr, "that no two men who have made our profession what it is have entered it by the same path, and that many of the most eminent of them have had no training that would to-day be regarded as a normal one, either in respect of education or of practice. . . . There is need in the profession for men of widely different qualifications; let us not aim at turning out our recruits like so many forgings stamped in one set of dies."

There is no conceivable specification for a course of training and study which will meet every case successfully. Physique, temperament and incentive all play modifying parts. Some types of mind are fostered and others fettered by the same environment. The first essential to which end all teaching must be directed, whether in the public school or college, is that of training the student to teach himself. The development of the reasoning faculties and of the ability to draw sound deductions is of paramount importance.

We cannot but regard some phases of the examination system as inimical to this. So long as it is possible for men to cram for examinations, so long will the satisfying of the examiners by a set of answers to a set of questions involve at least as much of the accidental as the intentional. No examination has been invented which will eliminate the unsuitable, nor is there one in existence (fortunately) which will prevent the progress of the exceptionally gifted. The examination may be regarded as a simple—one had almost said primitive—method of automatically causing the few to select themselves from the many. Entirely ignoring, as it must of its nature do, qualifications of physical fitness or financial incentive, it can only be regarded as a species of gate-keeper appointed to prevent the profession from becoming absolutely over-crowded. Ultimately, of course, the over-crowding must remedy itself; at present it is questionable whether the second period of education, by encouraging the fallacious idea that it is more or less synonymous with employment, is not worse than the first. If a man has to earn his own living—even if he has to earn the major part of his income—let him as soon as possible start on actual employment, at however small a salary. He will learn orderly habits, accuracy, and the practice of those small self-denials which make up a tactful

dealing with others engaged in a like pursuit. The most valuable part of education is that which is derived in daily life from an actually productive occupation.

The chief aim of education (except in the case of the moneyed few, who can afford to take it for purposes of culture) must be to fit the pupil to compete with his fellows in his endeavour to obtain a secure position in life, and to spend time in cramming for subjects which are known to be pleasing to the Olympian mind of this or that examiner, is only justifiable when the entrance ticket conferred by an examination is an absolute necessity, as in the case of many Government services. The latter, however, are specialised instances, with which the outside world has no business relationship and over which it exercises no disturbing influence. The engineering profession, however, is very intimately connected, both physically and mentally, with the doings of the world in general, so much so that the present time has been called the "Age of Engineering." In fact, any observant youngster must, of himself, from the surrounding objects of daily life, receive an education in engineering which would have been a liberal equipment to the pupil of 60 years ago. The college training should certainly be of use where carried out in so rational a manner as that commented on by Prof. Wertheimer, where it enabled the student and his guardians to determine at an early stage whether or no he were really fitted for the profession, thereby saving him and them considerable time, and very likely a large expenditure. Too often a college training is apt to be regarded as a method by which, in return for a certain sum deposited in the slot, a certain amount of knowledge is transferred to the student. The total absence of the commercial element from the college atmosphere often has a highly deleterious effect on the student, leading him to suppose the world a pleasant place where everyone is anxious to give full value for the highest possible quality, whereas it will take him a considerable time before he has educated even his own small circle up to that pitch of perfection. To aim high is, no doubt, a very excellent motto, but, until skill in shooting is attained, a certain amount of time must be spent in entrapping the smaller ground game necessary to the support of the hunter, otherwise he will not find himself in any condition to bring down the loftier trophies of the chase.

The summing-up of the matter, as conducted by Mr. A. F. Yarrow and Mr. Alexander Siemens, took the form of a series of proposals from the former, and some illuminating comments from the latter. Mr. Yarrow's clauses, which, with the caution of Royal Commission recommendations, were not put to the vote, but suggested as food for thought, embodied the following:—A proposal that the Council should endeavour to secure greater continuity between school and college courses, apparently a feeler towards an organised system of education, such as obtains in the leading Continental countries; alteration of the length of University terms, to allow of the sandwich system; and the recommendation as to co-ordination between colleges and employers, referred to previously as leading to a desirable solution.

Mr. Siemens pointed out that the professors and schoolmasters who had complained that they could not prepare a boy for a career unless they knew what that career was, were unable themselves to agree upon a syllabus for a standard examination to be accepted by the Universities and the learned professions as an entrance examination. Thus, in the most important department of education, the general fitting of a man for his start in life, a general disability to decide appears to have been evinced by the educational representatives. He was in favour of sending a boy direct to the shops for a year on his leaving school, and passing him into the university afterwards, and this impression, being the outcome of so wide an experience, may be taken as embodying the gist of the discussion.

Registration of Telephone Calls.

An animated correspondence has been taking place in the *Times* during the past three weeks on the subject of the registration of telephone calls by the Post Office, on the message-rate system. It arose out of a question put to the Postmaster-General in the House of Commons as to the method of registration; Mr. Samuel replied that no call could be registered on a line unless it were connected with another line, and said, "The registration is not entirely automatic, as it does not take place unless the operator depresses a key which controls the meter." We may point out that the phrase "not entirely automatic" is misleading; the registration is not automatic at all, being effected solely at the will of the operator, just as one rings an electric bell or switches on an electric lamp. The general complaint, expressed often in bitter terms, is that heavy overcharges are made — as much as 30 per cent. in excess of the actual number of effective calls made—and it is alleged that the operators are in the habit of recording ineffective calls and wrong connections. It is even averred that when the meter is read a percentage is added to the actual number of calls registered, to cover omissions on the part of the operator; we cannot suppose, however, that there is any valid ground for this charge, for it amounts to an accusation of deliberate fraud on the part of the Post Office. Complaints and protests, it is said, are unavailing; Lord Russell writes: "It is useless for subscribers to complain or to take legal action against a Government department, and only Parliament can help us." But that is the inevitable consequence of the establishment of bureaucratic control, as history has shown for ages past. The remedy is obvious.

Anglo-German Finance and Scandinavian Water-Powers.

It is reported from Berlin that negotiations are being conducted by an Anglo-German-Scandinavian financial group with regard to the consolidation into a company of a number of Norwegian and Swedish water-powers, under the title of the Hydraulic Power and Smelting Corporation, and with a share capital of £1,000,000 and debentures of £1,000,000. The scheme relates to waterfalls already in use and yet to be used, as well as to some of the establishments supplied by them. The assets to be brought into the undertaking include the zinc smelting works and zinc refinery at the Trollhättan Falls and in Sarpsborg, and the water-power of 126,000 H.P. at the mouth of the Tysse mountain stream in the Hardanger Fiord. The latter installation is already equipped, or in process of being equipped, for 57,000 H.P., and the turbo-generators have been used for years past for supplying the carbide and cyanamide works in the neighbouring Odda, in which the German Siemens group is interested. As concerned with the scheme in Germany are mentioned the A.E.G., the Siemens-Schuckert Works and the Berlin Electrical Enterprises Co., together with the banks associated with them under the lead of the firm of S. Bleichroder, and it is said that the formation of the company should afford opportunities for employment for the Teutonic electrical industry. The question arises whether, as in the case of the Victoria Falls Power Co., this means that an English company is to be constituted largely with English capital to provide orders for German works. If so, it is about time that those who supply most of the capital should also determine the allocation of the contracts which may have to be concluded.

SOME PROTECTIVE RELAYS FOR ALTERNATING-CURRENT CIRCUITS.

By KENELM EDGCUMBE.

(*Continued from page* 128.)

Minimum or No-Voltage Relays.—These relays, which are usually required to be instantaneous in their action, are mainly of one or other of the patterns already alluded to, with this difference, however, that the contact is normally held open, and so soon as the current energising the coils falls *below* a certain minimum value, the mechanism is released and the contacts are closed. In other respects no-voltage relays are similar to those of the overload type, and need not be further dealt with.

Reverse or Discriminating Relays.—There has been considerable controversy in the past on the subject of reverse relays: some engineers being at one time of the opinion that such instruments were liable to become a greater evil than that which they were intended to cure. The cause of this feeling was not far to seek. The majority of the reverse relays on the market were, and still are, merely induction wattmeters carrying contacts, which are held open so long as power is being transmitted in one direction, but close as soon as a reversal of power takes place. They are, in fact, frequently called "reverse-power" relays.

In the writer's opinion, this indicates an entire misconception of the function of such instruments, which is not that they should be brought into action by a reversal corresponding to a definite amount of *power*, but to a definite value of *current*. The voltage is, in point of fact, only involved in so far as it determines the direction of current flow, and the question of this voltage falling or rising should have no effect whatever upon the action of the relay. As an example, one of the most common uses to which reverse relays are put may be cited, viz., the protection of a number of alternating-current generators running in parallel on the bus-bars. Should a fault develop in one of them, the remaining machines will feed current back into the faulty generator, and it is the duty of the relay to remove this latter machine from the bus-bars before any damage is done. If the fault is a bad one, it will almost certainly be accompanied by a very considerable drop in pressure, and a reverse-power relay will, under such conditions only act with a correspondingly increased current. For example, it is no uncommon thing, under such circumstances, for the pressure to fall to one-tenth of its normal value, or even less, and in that case the relay will not cut out until the current has risen to 10 times that for which it is set.

To meet these conditions, it is usual to specify that a reverse relay shall act with not more than 10 per cent. or 20 per cent. of the full-load current, even if the pressure falls to 50 per cent. of its normal value. In the case of a reverse-power relay, the designer has no alternative but to reduce the working forces until the relay will act with one-tenth (or one-twentieth, as the case may be) of the full-load power. This necessarily means that the control has to be so far reduced as to make the relay extremely delicate, and mercury contacts become almost a necessity. But there is a still more serious disadvantage attending this solution of the problem, viz., that a comparatively small momentary reversal, such as that due to a bad parallel, or, still more, to a surge on the line, may be quite enough to trip the relay, seeing that these instruments to be really effective should, in most cases, be of the instantaneous type, in order that a faulty generator may be rapidly removed.

It is this liability to cause the circuit breakers to come out unnecessarily which has led some engineers to express the unfavourable opinion on the subject of reverse relays, already alluded to. With a view to preventing the tripping of the relays in the event of a "bad shot" in paralleling, a press button is sometimes provided which temporarily cuts them out of circuit, but this affords no protection against surges.

As has been said, the writer's view is that a reverse relay should be a reverse-*current* relay, and not a reverse-power relay, and the instrument shown in figs. 10 and 11 is designed in accordance with this conception. It consists, essentially, of an iron-cored dynamometer movement having a pivoted pressure coil M C and a fixed current coil C C. On the limbs of the magnet are two coils O C connected across the mains through a resistance R, in series with one another, and with the moving coil M C. A weight W normally holds the contacts C open, and current is sent through O C in such a direction as to assist the winding C C when a forward current is flowing through the latter, thus assisting the weight W to

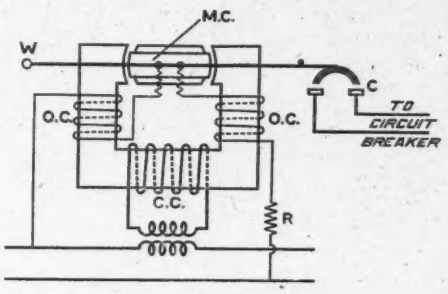

Fig. 10.

hold open the contacts C. Upon a reversal, O C opposes C C, and if the reverse current in the latter is gradually increased it will, first of all, neutralise the ampere-turns of O C, thus wiping out the flux in the electromagnet, and finally

Fig. 11.

reverse it. So soon as a pre-determined value of reverse current is exceeded, the torque so produced will overcome the weight W and close the contacts C. It will be observed that if the pressure falls, the opposing ampere-turns due to

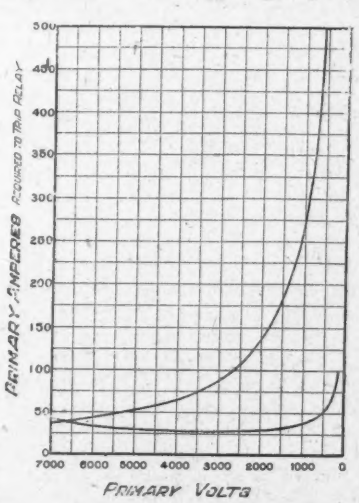

Fig. 12.

O C also decrease, so that a smaller reverse current in C suffices to produce a given flux, or, what comes to the same thing, a given reverse current in C C produces a larger effective flux.

D

The effect of this is very clearly seen in the lower curve of fig. 12, which represents a typical curve obtained with one of these relays, and shows the relation existing between the bus-bar voltage and the current necessary to trip the relay at that particular pressure. The normal primary voltage in this case was 6,600 volts, and the full load primary current 40 amperes. The relay was set to trip with this current at normal voltage, and as the pressure falls it will be noticed that the current necessary to actuate the relay at first falls slightly (at 3,000 volts it is approximately 30 amperes), and then gradually increases until at 660 volts (or one-tenth of the normal) it is something under 50 amperes.

Thus it may be said that for all practical purposes the relay in question *responds to a given reverse current, irrespective of the pressure*, and, as a consequence, this tripping current may safely be made the full load current of the circuit, or, at any rate, need never be made less than half this value. Hence it follows that such a relay can be made very robust, and may be provided with carbon contacts in place of mercury. Besides this, it is self-resetting so soon as the circuit has been opened by the breaker, and, above all, it has no tendency to act with a trifling reversal, such as often occurs, as has been said, through a local surge on the system.

The upper curve in fig. 12 shows the corresponding curve for a reverse-*power* relay of well-known make, and the contrast is remarkable. In this case, the increase of current with a falling voltage is enormous. For example, at 3,000 volts it amounts to 90 amperes, and at 660 volts (that is, at one-tenth the normal pressure) it is increased to no less than 500 amperes, or, in other words, the relay will not operate under these conditions with less than 1,000 per cent. overload.

In view of these facts, the statement, still sometimes made, that the working of a reverse-power relay is practically independent of the voltage, is, to say the least of it, misleading. What is most probably meant, is that such a relay will trip with a given amount of power irrespective of the voltage. Unfortunately, however, it is an excessive *current* which does the damage. To take, as an example, the case already cited of a number of generators running in parallel and each protected by a reverse relay; on the occurrence of a short in one of the generators, the healthy machines will at once send current into the faulty one which represents a dead short across the bus-bars. The voltage may well fall to something like 10 per cent. of its normal value, and under these conditions the relay will not act until the current flowing into the faulty machine amounts to more than ten times the full load, great damage being done in the meantime.

The trouble is often aggravated by the fact that the current and voltage may be out of phase with one another, and as the tripping of the relay depends upon volts × amperes × power factor, the necessary current is still further increased. In fact, as was first pointed out by Mr. Leonard Andrews, to whose initiative the use of reverse relays in this connection is largely due, it is possible, under certain conditions, for a generator which has lost its field to give a forward current of extremely low power factor, instead of taking a reverse current at all. Although the current is a forward one, it has the same effect on the system as a short-circuit, and for this reason he suggested that reverse relays (or "discriminating relays" as he preferred to call them) should be given a spurious phase displacement so as to make them act, not only with a reverse current, but also with a forward current of very low power factor. This is easily done with most forms of reverse relay, but a very simple arrangement, and one often adopted, is to place a small trip coil in the generator field circuit, so arranged that should the exciter current fail from any cause, the circuit-breaker will be opened and this particular generator isolated.

Some engineers prefer that, instead of the relay opening the circuit-breaker direct, it should light up a signal lamp so as to give warning to the attendant that something is wrong with that particular circuit, it being then left to him to clear the fault.

Another position in which reverse relays are very frequently used is at the further end of feeders where they enter a sub-station, to prevent current from the motor-generators installed there from flowing back along the feeder into a fault, should one develop. In such cases, the low settings already alluded to are particularly inadvisable, owing to the surges often set up by the hunting of the sub-station plant with any sudden change of load. Such hunting is usually quite temporary and harmless, and it is most undesirable for the feeder circuit-breaker to be opened thereby. On the other hand, owing to the resistance of the feeder, it is probable that on the occurrence of a bad fault, the pressure will fall to a very serious extent, so that a relay such as that illustrated in figs. 10 and 11, which is practically independent of the pressure, is clearly called for.

Differential or Balanced Relays.—For the protection of inter-connectors and ring mains, a reverse relay is unsuitable, owing to the fact that the current may normally be flowing in either direction. On the occurrence of a fault in such a feeder, however, more current will naturally flow in at one end than flows out at the other, or if the fault be a bad one, current may even flow in at both ends, and in the Merz-Price balanced system, this fact is made use of. Roughly, this system may be said to consist in placing a current transformer at each end of the line, with their secondaries connected in opposition to one another, and in series with the tripping coils of relays at each end of the feeder to be protected.

This arrangement is shown in fig. 13 as applied to the protection of a three-phase feeder; C T_1, C T_2, &c., represent the six current transformers, three being connected at either end of the line, with their secondaries in opposition as just described. So long as the currents flowing in at one end

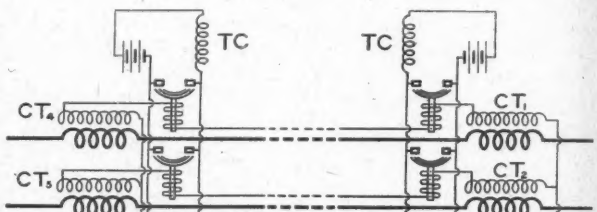

Fig. 13.

and out at the other end are the same, the secondary E.M.F.'s of the current transformer will be equal and opposite, and no current will flow through the relays. If, on the other hand, some of the current finds its way back through a fault, this balance is disturbed and current flows round the secondary circuit and so trips the relays.

This arrangement, though extremely simple in principle, entails considerable complication in practice. In the first place, a number of pilot wires are required running from end to end of each feeder, and again extreme care is necessary in the design of the current transformers. It is essential that they should balance correctly, not only between zero and full load, but up to a very considerable overload, since it is a fundamental principle of this system that, no matter how great may be the overload, the relays shall not act. With the arrangement shown in fig. 13, moreover, in the event of a severe earth on the feeder destroying one or more of the pilot wires, the relays will be thrown out of action, and, although other methods of connection are available, whereby this objection may be overcome, the possibility has to be carefully borne in mind.

For these and other reasons, many engineers prefer to rely upon overload relays for the protection of their inter-connector feeders and, provided proper discrimination is obtained so as to ensure that the feeder relay shall trip before that at the generating station, adequate protection is afforded, and this with a minimum of expense and complication. On the other hand, for the protection of ring mains, the Merz-Price system undoubtedly affords a very satisfactory solution, but unfortunately enthusiasts have advocated its use in season and out of season for every kind of protection, and in many cases where it is by no means so suitable.

For example, its use is suggested for the protection of generators running in parallel in place of the reverse relay arrangement already dealt with. According to this scheme no less than six current transformers are required for each

generator as well as the three-pole relay, besides which the winding of the generator has to be broken into on each phase between the coils and the neutral point for the insertion of three of the current transformers, which is not always, by any means, convenient.

Fig. 14 shows the primary connections in a diagrammatic way. C T_1, C T_2, &c., represent the six current transformers, the secondaries of which are connected in opposition, pair by

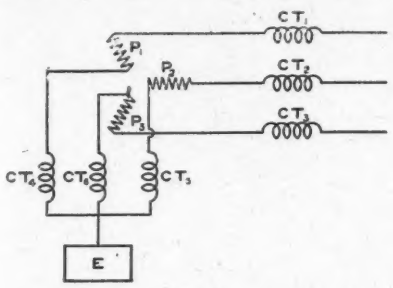

Fig. 14.

pair, and are also joined up to a three-pole relay. P_1, P_2 and P_3 represent the three phases of the generator windings. Under normal conditions, the currents in the transformer secondaries balance, as has already been explained, so that no current flows through the relay. On the occurrence of a short circuit between phases, however, this balance is disturbed and the relay trips.

Apart from its unnecessary complication, it will be observed that, although this system is effective against a short circuit between windings in different phases, it affords no protection whatever against a short between the windings of a given phase, which may constitute a very serious fault. Practically the only advantage which can be claimed for this, as compared with the more usual form of protection by means of reverse relays, is that it is unaffected by a fall in the bus-bar voltage, but while this argument may be valid when speaking of reverse-power relays, it does not apply when considering those of the reverse-current pattern, as already explained.

The differential balanced relay can also be employed for the protection of duplicate feeders, but in this case it appears to possess no advantage over the reverse-relay arrangement (one of the latter being connected at the further end of each feeder), and labours under the very serious disadvantage of requiring pilot leads for each phase, running from end to end.

In some cases the differential balanced system has been employed throughout the entire system, each individual part being protected by a pair of current transformers, in the way already described. There are, however, two very serious objections to this course. In the first place, it is extremely difficult to protect against a bus-bar fault, either at the generating station or in a sub-station, and in the second place, the failure of a single relay out of the very large number connected in series leaves the whole system absolutely without protection right back to the main generators. That this is the case will be clear when it is remembered that each link in the chain forms a perfectly independent unit, designed to protect the particular section allotted to its care, without reference to those in front of or behind it.

This is such a serious disadvantage that many of the most enthusiastic advocates of the balanced system recommend the inclusion of overload relays as an extra safeguard, and this being the case, it would seem better to rely upon the latter exclusively, with the possible exception of the protection of interconnectors. By this means perfect discrimination can be provided, and each "protection point" has a second line of defence behind it.

(To be continued.)

Strike in Manchester.—A strike is in progress at several engineering works in Manchester, owing to the labourers demanding a minimum wage of £1 per week instead of the present rate of 17s. or 18s. About 9,000 men are idle.

DAY-LOADS FOR CITY ELECTRIC LIGHT AND POWER STATIONS.

By JOHN B. C. KERSHAW.

III.—Ozonisers for Ventilating and Similar Purposes.

The writer in the two previous articles of this series* has discussed applications of electricity in two distinct types of works found in all large centres of population and industry, namely, in iron foundries, and in laundries and dry-cleaning works. In this article, it is his purpose to discuss an application of another character, that has already progressed beyond the experimental stage, and is likely in time to become a regular feature of all large offices, and of all well equipped public buildings and institutions in the country.

This application is the use of electricity for purifying foul and vitiated air, by producing within it small percentages of that most active oxidising agent, ozone. This gas, it may be stated here, for the benefit of the uninitiated, is a condensed form of oxygen, and can be produced from the latter gas in various ways, chief of which is the electrical method by silent (*i.e.*, sparkless) electric discharges through dry air. Ozone is formed electrically, when a static electrical machine is worked in dry air; during thunderstorms; and also in some unexplained way by the action of the sun and tides on long stretches of sandy shore, and by the movement of clouds and air around mountain summits. In all these cases it is supposed a silent discharge of electricity is occurring through the air, and ozone is produced in large or small amounts according to the surrounding conditions. The amount of ozone found in the air is never great, but when one considers the extent of the atmosphere, the aggregate amount of ozone formed by natural agencies under favourable conditions must be exceedingly large. Ozone can always be detected by its peculiar odour in the air of many seaside and mountain resorts, and the invigorating character of these places is generally ascribed to the continual presence of the gas.

Although it is quite impossible by artificial means to give the air of closed and crowded halls or rooms the freshness and bracing characteristics of the air of health resorts, there is no doubt whatever that much more might be effected in this direction than is yet attempted, and that by the installation of more efficient systems of ventilation and purification, the fœtid and germ-laden air which we are at times called upon to breathe in crowded tramcars, motor-'buses, railway carriages, theatres, concert halls and other public places and buildings, might be rendered far less poisonous and dangerous to the average man and woman.

The ozone, when produced by artificial means and added to foul air, acts in two ways. As a concentrated form of oxygen it restores the balance between the oxygen and the inert or useless gases of the atmosphere, and thus renders breathing easier for those affected with any heart, bronchial, or lung troubles. Its more important services are, however, as a most active oxidising agent and as a germicide. The minute particles of organic matter floating in the air of all places and buildings crowded with men and women, due to the exhalations from their lungs and bodies, are burnt up and rendered harmless by ozone, while a large number of bacteria and of disease-producing germs are also rendered inactive or killed outright by this health-giving gas. If a sufficient supply of ozone can, therefore, be maintained in any place where men and women are herded together in a confined space, the harmful results will be reduced 50 per cent. and many serious illnesses will be entirely avoided.

It is not the writer's purpose in this article to deal with systems of ventilation, though these provide a fine field for the application of scientific principles, and for the installation of electrical machinery. The installation of one or more electric fans, churning up air already foul and creating draughts where they are least wanted, is not "scientific ventilation," but the reverse, and the sooner this is recognised, the better for all concerned. The first essential of all systems of ventilation is that they shall substitute pure air for foul air.

* See Electrical Review for May 12th and May 26th.

The aim of the writer in this article is to describe the more up-to-date and practical forms of electrical ozonising apparatus, designed specially for the duty with which he is dealing. Although this particular application of electricity has been slow in developing, and has been disappointing for some who entered into it in the early days, the progress made in recent years has been considerable, and quite justifies the writer's claim that in time no public vehicle or building will be considered well-equipped, which does not possess adequate and efficient ventilating and air-purifying machinery and apparatus.

In Germany the well-known firm of Siemens & Halske is making a speciality of this application, and has brought out several designs and sizes of ozoniser for air purification and ventilation purposes. These are, as regards the ozonising element, modified forms of the original tube ozoniser constructed by Werner von Siemens in the year 1875. This ozoniser consisted of two glass tubes, one slightly larger than the other, fixed concentrically, and coated evenly with tinfoil on the two faces most distant from one another. The metallic coverings were then connected with the terminals of a high-potential electric machine, and a current of filtered and dry air was passed through the annular space between the two glass tubes where the sparkless discharge occurred. Under these conditions ozone was produced in quantities dependent upon rapid withdrawal of the air to avoid over-heating, and upon the absence of sparking, over-heating and sparking being conditions which have an unfavourable effect upon the output of ozone. The present day ozoniser of Siemens & Halske is still of the tube type, but the inner glass tube has been replaced by a metal cylinder, and the outer tube is surrounded by water. The sparkless electrical discharge occurs between the inner metal cylinder which is connected to the source of high-tension electricity and the external metal coating of the surrounding glass tube, which is kept at the earth potential. The oxygen of the air, passing through the annular space separating the metal and glass tubes, is thus ozonised. The ozoniser is increased in capacity simply by adding to the number of tube units, and figs. 1, 2 and 3 show the forms in which it is used for ventilating purposes. In their latest publication relating to this application, Messrs. Siemens & Halske give a list of 34 large installations of ozonisers for ventilation and air purification in Berlin and other towns in Europe, the list including the German Parliament House, the Town Hall at Amsterdam, the freezing chambers of the slaughter houses at Cologne, Dusseldorff, Potsdam and Erfurt, and a large number of theatres, concert rooms, hotels and banks, &c. The largest of these installations is that of the Reichstaggebaüde, in Berlin, which has a capacity of 200,000 cb. metres (7,070,000 cb. ft.) per hour. The ice skating rink at the Admiral Palast, Berlin, is another big installation, producing 30,000 cb. metres (1,060,500 cb. ft.) of purified air per hour.

The "Playing Hall" at the Monte Carlo Casino is, however, likely to be better known in this country than either of the above. An ozonising installation producing 2,121,000 cb. ft. of purified air per hour is attached to this public gambling saloon for the comfort of its patrons, who cannot, therefore, in future ascribe their ill-luck to any form of cerebral disturbance produced by the vitiated and overheated atmosphere they were formerly called upon to breathe.

The Ozonair Co., of London, appears to be the only company in this country which has made a permanent success of the manufacture and application of ozonisers for various purposes, including that of air purification. Many of the earlier inventors and experimenters in this field of research (as so often happens) have failed to weather the trying period which usually separates the introduction of any new invention or application from its ultimate success.

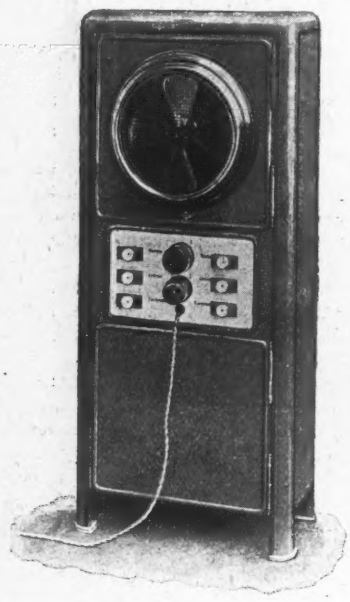

Fig. 1.—Ozoniser for d.c. Circuit.

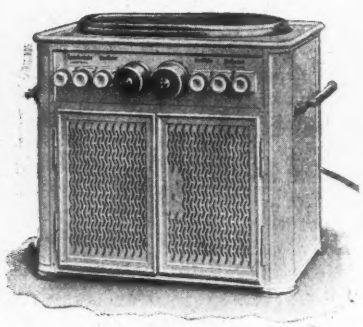

Fig. 2.—Vertical d.c. Type.

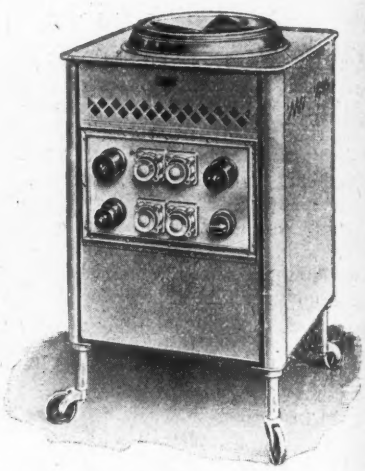

Fig. 3.—Portable Set.

Siemens Ozonising Apparatus.

The Ozonair Co. owns the patents of the Rosenberg type o ozoniser, which differs from that of Siemens & Halske in several important details. The ozoniser is of the plate type, no dielectric of glass or other material separates the two discharging surfaces, and sparking is avoided by employing copper gauze as the electrode material. Each complete element of the Rosenberg ozoniser is composed of a thin sheet of micanite, covered on each side by copper gauze, of 40 meshes to the inch. The air is passed between two or more of these gauze ozonising elements placed at a distance apart of 4 in., electricity at 4,500 volts being employed to give the silent discharge. The absence of sparking under these conditions is ascribed to the large number of rounded projections

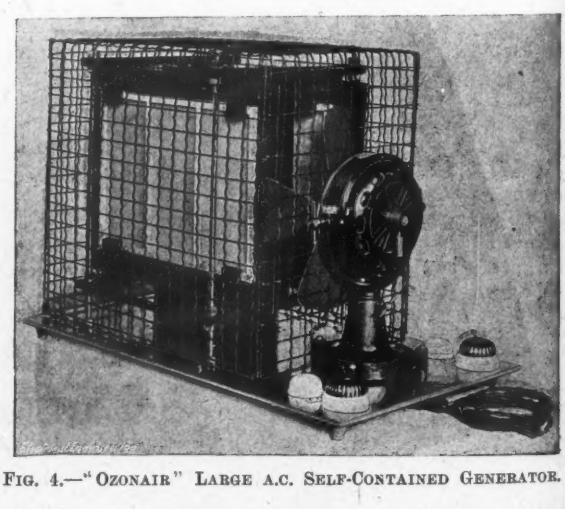

Fig. 4.—"Ozonair" Large a.c. Self-Contained Generator.

(230,000 to every sq. ft. of gauze surface) from which the discharge occurs, no single point of this being at a sufficiently high potential to bridge the space with a spark. The Rosenberg ozoniser is made in various sizes and forms, as shown in figs. 4, 5 and 6. The company is able to give a list of 26 firms, &c., who are now using its ozonisers and apparatus for air purification in the United Kingdom, and states that a large number of equipments of ventilating

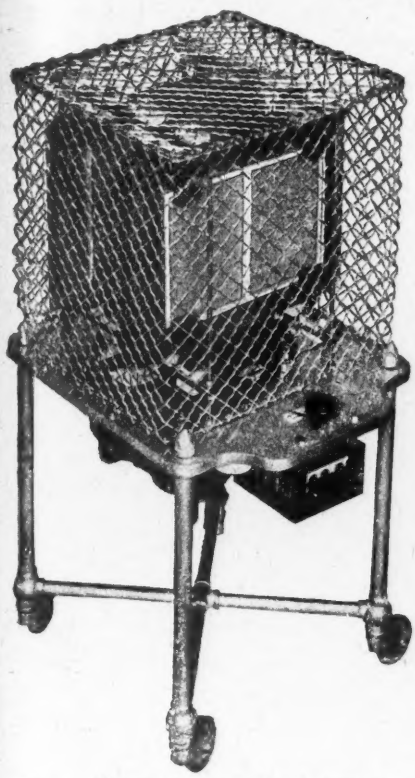

Fig. 5.—Large Portable d.c. "Ozonair" Generator for Hospitals.

Fig. 6.—Small Portable Generator.

and ozonising apparatus have been sent to clients in the Colonies and abroad. Included in this list of English users are the following :—D. H. Evans & Co., Oxford Street ; Lloyd's ; the Royal Exchange ; His Majesty's Theatre ; the Piccadilly Hotel ; and the Royal Courts of Justice.

As regards the yield and working costs of the two types of ozoniser described in this article, the only tests that have come under the writer's notice give 184 grammes of ozone per H.P.-hour for the Rosenberg type of ozoniser, and 20 grammes for the Siemens & Halske type. It is quite probable that the first named yield is too high, and the second too low for the present-day machines, and that from 75 to 100 grammes of ozone represents their average yield under normal working conditions. These figures represent an efficiency of from 7·5 to 10·0 per cent. The cost of 1,000 grammes of ozone depends chiefly, therefore, upon the cost of electrical energy, and will vary from 7d. upwards, according as the KW.-hour costs 1d., or more. Coming to more practical figures of the cost of air purification, Messrs. Siemens & Halske state that the electrical power required for an ozoniser dealing with 1,000 to 5,000 cb. metres (35,000 to 175,000 cb. ft.) of air per hour lies between 30 and 150 watts, and that a complete ventilating equipment, including the fan, for a building requiring 21,000 cb. ft. of purified air per hour could be run with a power consumption of 175 watts. Ozonair, Ltd., give 70 and 130 watts as the power required for installations producing 30,000 and 60,000 cb. ft. of purified air per hour respectively.

The power consumption decreases with the size, and a complete Siemens & Halske equipment yielding 189,000 cb. ft. of ozonised air per hour could be run with a power consumption of 590 watts.

These figures do not allow the cost of the actual ozone to be calculated, as the concentration of the ozone in the treated air is not stated ; but they show that the cost of air purification by means of ozone is not prohibitive, and that, in view of the benefits which may be obtained in health and freedom from illness, the cost may be regarded as trifling. It is important, however, that the air should be filtered and dried before passing into the ozoniser, and some of the past failures have been due to neglect of these essential conditions of success.

Postscript.—In Article I* of this series, the writer regrets that no mention was made of the fact that the Rapid Magnetting Machine Co., of Birmingham, have for some years manufactured and placed on the market in this country electromagnetic machines for recovering iron from all kinds of waste materials, including cupola slag and ashes, foundry sand and box-makers' waste and sweepings. The company named have supplied machines of this character to many of

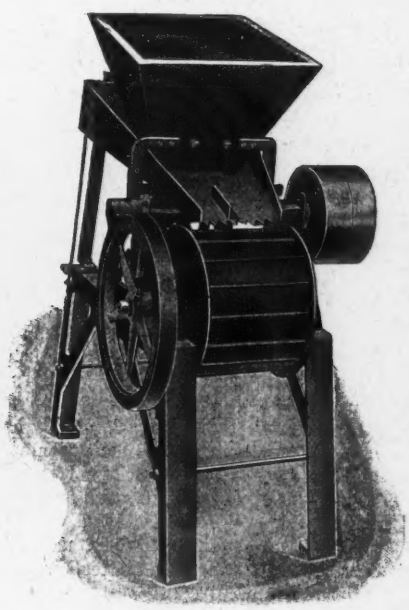

Fig. 7.—"Magnetting" Machine, Standard Type.

the largest firms in the general engineering and metal industries in the United Kingdom, and also to many firms engaged in other manufactures, H.M. Government, at Woolwich Arsenal and Dockyard, being among the users of

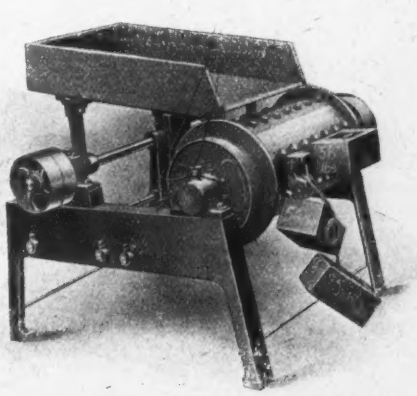

Fig. 8.—"Magnetting" Machine, Type E.

the machines made by the Birmingham firm. This fact cuts the ground from under the implied reproach that manufacturers in this country were not alive to the value of these important and waste-saving devices, and were neither manufacturing them nor using them.

Two of the machines made by the Rapid Magnetting Machine Co. are illustrated herewith in figs. 7 and 8 ; they differ from those described in Article I only in the arrange-

* Electrical Review, May 12th.

ment of the internal electromagnets which produce the external magnetic field. These electromagnets are placed radially with their poles towards the inner surface of the revolving drum, which is made with lateral ribs or with studs to assist in retaining the magnetised particles or pieces of iron.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Battery Maintenance.

I notice under your "Correspondence" columns in the ELECTRICAL REVIEW for the week ending July 28th, a letter on battery maintenance, signed by "J. S." Your correspondent objects to a graduated system of payments being adopted, but it must surely be obvious that, particularly with new stations, it is not only desirable, but quite sound financially, to keep the payments for maintenance during the first few years low, increasing them as the wear on the battery increases, and, incidentally, as the revenue of the station is better able to afford the increased expenditure. This argument is so logical that I should not have referred to the letter from "J. S.," but for his remarkable final statement, where he says: "It seems to me a most reprehensible practice to maintain under such a scheme as this, as it necessarily means penalising the future ratepayers for the sake of the present ones."

What can "J. S." mean? Surely he understands that the revenue of an electric power station, whether company or municipally owned, is contributed by the consumers, and that all such charges are paid out of the revenue thus received.

What, then, has the ratepayer, unless he is also a consumer, got to do with the matter, either at the present or in the future?

I fear that "J. S." has, perhaps unwittingly, used one of those expressions which sound so glib and mean so little, but the "grievances" of the ratepayer, particularly where municipal electrical undertakings are concerned, have, during the past, been so very much overrated that it seems a pity for such a misleading expression to be allowed to circulate in a technical journal.

Percy E. Rycroft,
Engineer and Manager.

Electricity Works, Hounslow,
July 31st, 1911.

Representatives Abroad.

It is good to see your leader of July 14th emphasising the importance of our manufacturers maintaining expert engineering representatives abroad. This happens to be a matter which some amount of travel and residence in the Colonies has brought prominently to my notice.

With many manufacturers the usual plan appears to be to appoint some firm of general agents, whose principal business is handling goods of a character remote from engineering apparatus. Now such appointments defeat their object, because the qualified engineers who may have orders to place want to discuss engineering matters with engineers. To send non-technical men out from home is still worse, for there are more than enough of that type already abroad.

It is by meeting in business and at engineering societies that engineers learn much from each other, and those already abroad are more dependent on this method of keeping in touch with what is going on than we are in England. If anything, therefore, the representative abroad should be a better man than would be appointed to a similar position in, say, London.

Some time ago, I ventured to define the trader engineer for abroad as follows: In addition to a workshop training he must have drawing office and estimating office experience. He should be of good address, athletic, tactful, and be socially inclined. He must be equally at home in discussing an engineering paper before a scientific society and in talking over financial matters with the manager of a shipping house or bank. He should not only be able to follow up and clinch a Government or municipal contract where the money is safe, but he must have the "nous" to assist those of his long-credit customers who he thinks will succeed. Many a firm's success has been due to the fact that it helped along some "battler" in his early days.

Further, the representative should be able to talk to a possible customer in such a way that the customer can easily follow the argument. To "snow" one man under with a technical description may be as wrong as talking in too elementary a way to one who is highly trained technically.

Our present methods of training young engineers are not calculated to turn out quite the right sort of man, partly because they have so few facilities for gaining knowledge in estimating and commercial work. It should not be difficult, however, to make the necessary change, for we have splendid material to work upon.

E. Kilburn Scott.

Bromley, *July 27th*, 1911.

LEGAL.

ELECTRIC LAMP TRADE MARK.—REGISTRATION OF NAME REFUSED.

IN the Chancery Division on Thursday, July 27th, Mr. Justice Warrington heard an application by Pope's Electric Lamp Co., Ltd., to be allowed to proceed to the registration of the name "Pope" in connection with their incandescent electric lamps. From the time of the commencement of their business, or very shortly afterwards, the company adopted the practice of putting the name "Pope" on their lamps, the packages in which the lamps were enclosed, their circulars and advertisements, and used the name in connection with their lamps in many other ways. By this means in the trade, and with those who were familiar with the names of the various manufacturers of incandescent lamps, the lamp bearing the word "Pope" had come to mean a lamp manufactured by Pope's Electric Lamp Co., Ltd.

MR. A. J. WALTER, K.C., who appeared with Mr. J. H. Gray for the applicants, said the application was made to the Board of Trade in accordance with the usual practice, and the Board referred the matter to the Court. There were two questions to be considered; first, was the word distinctive; and second, if not, had it acquired a distinctiveness in prior user.

The ATTORNEY-GENERAL, who appeared with the Solicitor-General, and Mr. Sargent for the Board of Trade, asked the Court in the exercise of its discretion not to allow the name of a manufacturer to be deemed to be a distinctive mark. This was entirely a matter of discretion, assuming that the applicants had brought themselves within the section of the Trade Marks Act, 1905. If they were within the section, if once they established that the name was a distinctive mark—that it was adapted to distinguish, they had still to satisfy the Court that it was a right case in which the Court ought to allow the mark to be deemed a distinctive mark. The applicants must not have a monopoly of the use of a particular name any more than they could have the right to the use of a laudatory epithet. If the Court should exercise its discretion in favour of permitting the applicants to proceed to registration, it would follow that the trade marks of the future would consist to a very large extent of names.

His LORDSHIP said that, in his opinion, the name being for all essential purposes the name of the manufacturer was not adapted to distinguish the goods of the manufacturer from the goods of other persons. There were many persons of the name of Pope, and the name of one man named Pope was not adapted to distinguish his goods from those of another manufacturer of the name of Pope. If it was not in its nature so adapted, then it seemed to his Lordship it could not become adapted by any amount of user. Even if it was, and the evidence established that the name was distinctive, in either view of the case the Court ought not to make the order asked for. He must, therefore, refuse the application.

The SOLICITOR-GENERAL said as this was the first case of the kind under the section of the Act, the Crown did not ask for costs, but this was without prejudice to any future application of the same kind.

MUNICIPAL UNDERTAKINGS AND THE INCOME TAX.

ON Saturday last, in the Second Court of Appeal, the Master of the Rolls and Lords Justices Farwell and Kennedy delivered their reserved judgment in an appeal in the case of Leeds Corporation and Another *v.* Sugden (Surveyor of Taxes), disputing the method adopted by the Income Tax Commissioners in assessing the income tax payable in respect of the Corporation's undertaking and properties. Prior to 1901 the Corporation had raised money for various undertakings, and in respect thereof had given specific charges on specific undertakings. In 1901 the Corporation obtained a private Act consolidating the various loans and creat-

ing a fund out of which the interest on the loans was to be paid. Into that fund the profits arising from the various undertakings were to be paid, and in so far as this fund was insufficient to meet the total amount payable by the Corporation in dividends, it was to be augmented by contributions from the ratepayers. Prior to 1901, the Corporation had an electricity undertaking, tramways, water works, gas works and markets. Some of those were now being run at a profit exceeding the amount of dividend payable as interest on the loan, while others were not making sufficient profits for the purpose, and the ratepayers were taxed to meet the deficiency. The total amount of the dividends payable by the Corporation was £285,446, and the revenue paid into the consolidated fund from the various undertakings was £270,000, leaving £15,000 odd to be made up by the ratepayers. With regard to the £15,000 no question arose, but the Commissioners had assessed each undertaking separately, and with such regard to the consolidated fund as the Corporation contended, that on certain of their undertakings they paid the income-tax twice over. Though the Act of 1901 required that separate accounts should be kept with regard to each undertaking, the Corporation contended that it was merely for the purpose of book-keeping and adjusting the accounts between one class of ratepayer and another, and the intention of the Act was that all the various undertakings should, as regards revenue and expenditure, be treated as one, and the profits from one would go to meet any deficiency on another. The result of treating them separately for income-tax purposes was that the Corporation were required to pay income-tax on £78,519 more than they should. The Corporation claimed the right to take the sum necessary to make good any deficiency on one undertaking from the excess of profit made by another, before such profits were assessed for income-tax. The matter was brought before Mr. Justice Hamilton, who upheld the contention of the Commissioners against the Corporation, and from that decision the Corporation appealed.

The Appeal was argued by Mr. Danckwerts, K.C., Mr. Ryde, K.C., and Mr. Jeeves, for the Corporation; and the Attorney-General (Sir Rufus Isaacs), the Solicitor-General (Sir John Simon), and Mr. Finlay for the Crown.

In giving judgment, the Master of the Rolls said the question the Court had to determine was whether the Leeds Corporation could, as against the losses on certain of its undertakings, put the profits and gains arising from other municipal undertakings, and deduct a sum equivalent to the amount for the purpose of assessment of the income-tax payable in respect of the Municipal Corporation loans. In respect of each of the five undertakings large loans had been contracted which were chargeable either on the city fund or the consolidated fund, but in no instance did the security extend to both. Though the ratepayer contributed to both funds, the proportions payable differed, and there was express provision for carrying over the balance and net receipts after paying the interest on the money borrowed for the undertaking, to the city fund or the consolidated fund as the case might be. The Leeds Corporation Act of 1901 was certainly one of the most remarkable Acts that had ever fallen to him to attempt to understand. He said attempt, because he thought it passed the wit of man to understand it. By it, however, all the loans were charged indiscriminately on all the assets of the Corporation. All the charges were to rank equally, and *pari passu* without priority or preference. That, in his opinion, was the meaning of the Act, though one section seemed to contradict another. He came to the conclusion that the obligation on the Corporation was to pay the interest due on the various amounts without reference to the sources from which they were derived. Once they had decided that the whole of the interest was payable out of one common fund, the judgment of Mr. Justice Hamilton could not be supported, and the appeal must be allowed with costs, both of the appeal and in the Court below.

Lord Justice Farwell, in giving judgment to the same effect, said that he could see nothing in the Corporation Acts or the authorities cited to support the contention of the Crown that the Corporation was liable to be assessed on the profits of each separate undertaking.

Lord Justice Kennedy dissented in his opinion, he said the Act of 1901 in no way affected the Corporation's obligation, but was only to widen the scope of the security. He thought that the obligation to keep separate accounts was not imposed merely for book-keeping purposes. He came to the conclusion that not only were the profits and gains from one undertaking not used for another, but that they could not have been lawfully so used. He thought the judgment of Mr. Justice Hamilton was right and the appeal ought to be dismissed.

In accordance with the view of the majority of the Court the appeal was dismissed with costs.

Compensation for an Electrician.

On Thursday, last week, in the West London County Court, his Honour Sir W. Lucius Selfe was applied to for an award under the Workmen's Compensation Act, in favour of George Lane, an electrician's mate, of Leathwaite Road, Battersea, S.W., the respondents being Messrs. Garrett, Hunt & Co., electrical engineers, Central Parade, Catford, S.E. Mr. Engelbach, on behalf of the applicant, stated that while at work at a private house in Pembroke Road, Earl's Court, W., Lane was knocking a nail into a floor-board which had been removed to allow the wires to be laid, when part of the nail broke off and flew into his right eye, which it permanently injured. He put his earnings at 28s. per week. Applicant bore out this statement, and added that his left eye was now being affected, and he could not make much use of it without spectacles. The right eye was now practically useless, he being able to distinguish light and dark only. Answering Mr. Douglas Knocker (instructed by Vandam & Co.) for the respondents, Dr. Pouck said that the applicant could work as usual, but he must not do it for a full day, or without spectacles. Mr. Daniels, managing director of the respondent company, proved that since the accident applicant had earned a higher average wage than before, at a different class of work. He had completed his jobs in a workmanlike manner since the accident. —His Honour made an order for 4s. a week since January last till June, when the applicant resumed his employment.

Thermal Syndicate, Ltd., *v.* Silicaware, Ltd.

In the Chancery Division on July 31st, Mr. Justice Swinfen Eady gave judgment in this action, which was reported in our issues of July 21st and 28th.

His Lordship said the action was brought in respect of alleged infringement of letters patent granted to J. T. Bottomley and Arthur Paget for improvements connected with the working of silica. The patent disclosed a process whereby silica could be worked on a commercial scale. The great utility of such an invention was beyond question, but defendants disputed its validity and denied the infringement. The defendant company imported and sold in England articles made abroad from silica, the articles complained of by plaintiffs were said to be made on the Rhine. He had had great difficulty in ascertaining the actual process used in the manufacture of defendants' articles, but it appeared that they were made by semi-fused silica, so semi-fused by means of an internal resistance core. Defendants denied that their process made use of the pressure of internal gas in the same way as the plaintiffs. Their fusions, they said, were not cigar-shaped, but were cylindrical, the upper end open-mouthed or trumpet-shaped, from which the gases readily escaped. The hollowness was obtained by capillary action, the sand molecules receding from the carbon core. It was clear from the evidence that the plaintiffs' process, as described in their specification, was sufficient to achieve the purpose desired, whilst, on the other hand, the evidence of the defendants in regard to their exhibits was extremely unsatisfactory and unreliable. He was of opinion that the articles complained of were made by a process the same, or substantially the same, as that of plaintiffs' invention, and the separation of fused silica at the core was obtained by gas pressure. In his judgment the plaintiffs' patent was a valid one, and the defendants had infringed it. He would grant the injunction asked for, with costs, an inquiry as to damage, and a certificate of validity. He also made an order for immediate delivery upon terms that the plaintiffs undertook in case of appeal not to dispose of the articles so delivered up; or, in the alternative, an order for destruction.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Igranic Remote-Controlled Starter.

The Adams Manufacturing Co., Ltd., of 106, New Bond Street, W., have placed on the market an interesting starter, which we illustrate in fig. 1.

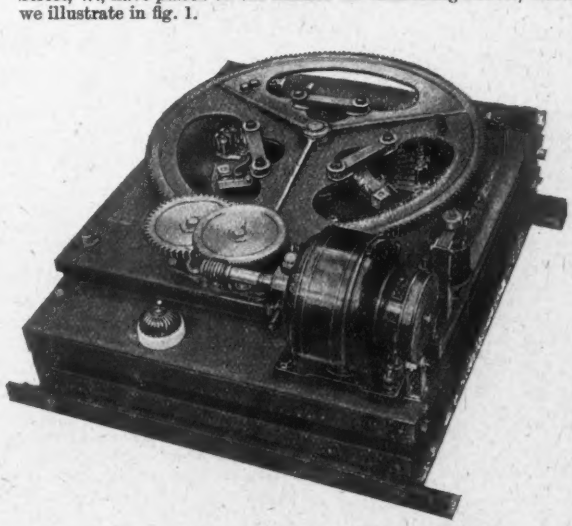

Fig. 1.—Igranic Motor-Driven Starter.

This starter is of the motor-driven three-phase remote-controlled type for use with slip-ring induction motors, and is operated by a tumbler switch fixed in any convenient position. With the switching "off" of the tumbler switch, the control motor brings

the controller into the off position, and it is ready for starting up again when required.

Our view shows the control motor geared to the spur-wheel carrying the brush contacts, &c.

G.E.C. Knife Switches.

The General Electric Co., Ltd., of 67, Queen Victoria Street E.C., have recently put on the market a complete line of chopper-type switches, which are manufactured at the Witton Works. The switches are made and stocked for maximum 30, 60, 100, 200, 300, 400, 600, 800, 1,000, 1,200, 1,600, 2,000 and 3,000 amperes, and any larger capacities up to maximum 10,000 amperes capacity can be made up at short notice. The advantage of the many sizes is that it does away with the necessity to pay for a 600-ampere switch for, say, 350 amperes, because the 600-ampere switch happens to be the nearest larger size.

The same general design has been carried through the whole range, and the appearance of the switches of different capacities is therefore quite similar, an advantage which will be readily appreciated by switchboard makers, because it certainly improves the appearance of a switchboard if the apparatus mounted thereon is of a uniform type.

The switches are amply dimensioned; the current density nowhere exceeds 1,000 amperes per sq. in. of sectional area for high conductivity copper, and 60 amperes per sq. in. of surface area in the contact clips. With regard to surface density, the makers believe

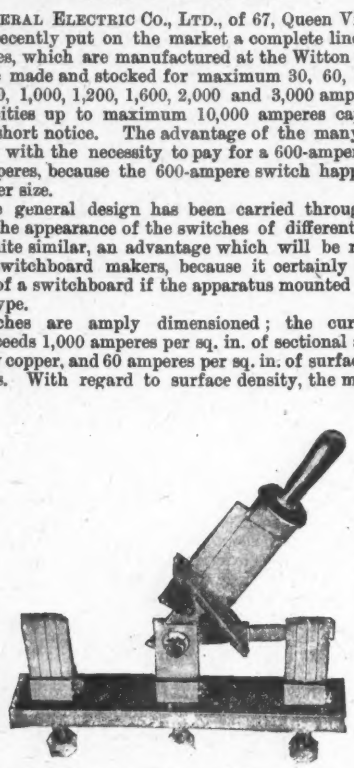

Fig. 2.—G.E.C. Change-over Switch.

these switches are the most amply rated of any obtainable; this is a decided advantage, as most losses in switches are due to insufficient contact surface in the clips, and in addition, this allows of the switches being overrated as much as 50 per cent. permanently without dangerous heating, and much higher for short periods, which may be handy in an emergency.

The illustrations explain the design very well. The flipper blades, which cause the quick break, are fitted with a steel stamping where they are hinged and the main blade is bushed with a steel bush for the hinge pin. This makes the actual wearing parts very strong. At the handle end, the main blades are provided with solid square steel blocks in which the handle is screwed. To hold

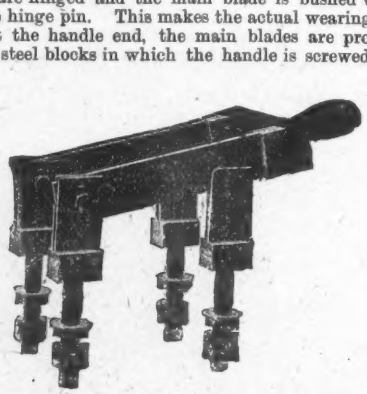

Fig. 3.—G.E.C. Double-pole Switch.

the blade in the "off" position in change-over switches, or where there is no room to swing the switch right over, shaped steel springs are provided, which are fixed to the side of the hinge contact and act on the rounded end of the flipper blade pivot pin. The switches are stocked "single," "double" and "triple" pole for front and back connections. A larger number of poles can be made up on short notice. The switches are jig made, and all parts are interchangeable. The finish is copper and black.

Vulcan Reducing Valve.

Messrs. Wm. Geipel & Co., of Vulcan Works, St. Thomas Street, S.E., have recently introduced a reducing valve, which they claim is both extremely accurate and durable. It is made in sizes ranging from ¾ in. diameter inlet to 10 in. inlet, and for medium and high pressures, the latter with and without superheat. Referring to fig. 4, it will be seen that steam enters at E, impinging on the bottom of valve V and top of the floating piston K, which is of larger diameter; a slight leakage is provided round the piston into the space r, past the valve k, controlled by the steel diaphragm p, and through channel C to the low pressure side A, and this controls the working of the main valve, as a drop in pressure at A results in the diaphragm valve closing, and the pressures on either side of the piston becoming equal, when the

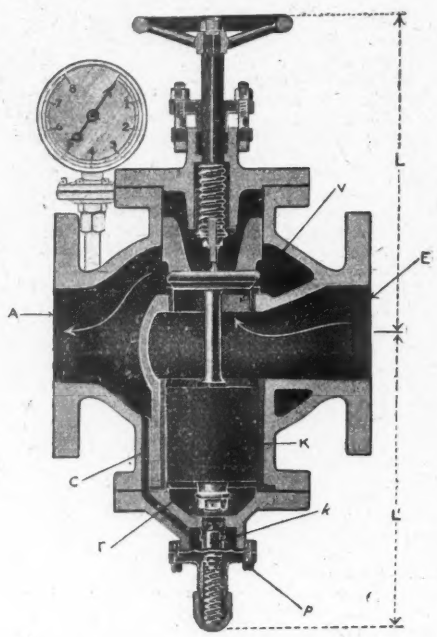

Fig. 4.—Vulcan Reducing Valve.

main valve V opens; while with an increase of pressure at A the diaphragm valve opens, reducing the pressure beneath the piston, which moves down closing the main valve V. A small spring below the diaphragm is provided, by means of which the outlet pressure can be adjusted with accuracy. The combined dimensions L L range between 13 in. and 42 in. in the smallest and largest valves.

Locking Spring Terminal.

A useful device, the invention of Mr. H. D. Thomas, is being introduced by Messrs. Bell Bros. & Co. (London), Ltd., of 104, Bishopsgate, E.C. As shown in the accompanying illustrations, it consists of a spring contact of phosphor-bronze, with a hump on its upper surface; the terminal nut is provided with a groove engaging with the hump, so that it is impossible for the nut to

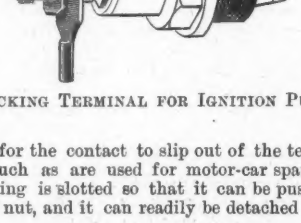

Fig. 5.—Locking Terminal for Ignition Purposes, &c.

slack back, or for the contact to slip out of the terminal. In the smaller sizes such as are used for motor-car sparking plugs, &c. (fig. 5), the spring is slotted so that it can be pushed on without disturbing the nut, and it can readily be detached by pressing the

Fig. 6.—Heavy Locking Terminal.

end of the spring with the thumb. Larger terminals (fig. 6) are drilled, and cannot be removed without taking off the nut; in this case the shape of the hump and groove is such that the nut can be turned with a spanner. Ample contact surface and spring pressure are provided.

Electric Device for Meat Marking.

In the course of his presidential address to the Conference of Veterinary Inspectors, at the Royal Sanitary Institute Congress at Belfast, on July 28th, Mr. J. A. Jordan (Belfast) urged the necessity for meat inspection and meat marking. He discussed the difficulties of meat branding, and said that a few months ago he succeeded in producing an electric device, of which the following was a description. The invention related to a portable electric

branding or stamping apparatus which would be instantly ready for use, and which would make a clear, absolutely indelible and unobjectionable mark upon the meat. It consisted of a portable stamp or brand-holder, preferably a rectangular box made of metal or other suitable material, and having a plate secured to it by means of bolts screwed into sockets provided in the bottom of the box. Holes were provided in the plate, and above it resistance coils were arranged and wrapped round mica, or equivalent strips encased in mica or other suitable covering. The resistance coils were at one end, suitably connected together, and at the other end they were connected to terminals joined to the source of supply of electricity by means of flexible wires. The stamp or brand might be of any desired shape, and made to give any desired mark on the meat; it was arranged above the resistance coils and secured to the holder by means of studs so that it could, if desired, be replaced by another brand. The box was provided with a handle, whereby the device might be carried about and be held against the meat for the purpose of branding. The arrangement of the device described was such that when the electric current was passed through the coils the brand above or in front of the coils would be heated to the desired degree, so that on placing it against the meat a corresponding mark or brand would be obtained thereon.

Neville Illuminated Sign.

We recently had an opportunity of inspecting the Neville electric sign at the offices of Messrs. Lund Bros. & Co., 78, Queen Victoria Street, E.C., who have the British rights for disposal. As will be seen from the accompanying illustrations, the sign is of very simple construction; it consists of two saucer-shaped disks, on the faces of which are the letters to be shown, and both faces are simultaneously illuminated by a single lamp, in the case of a

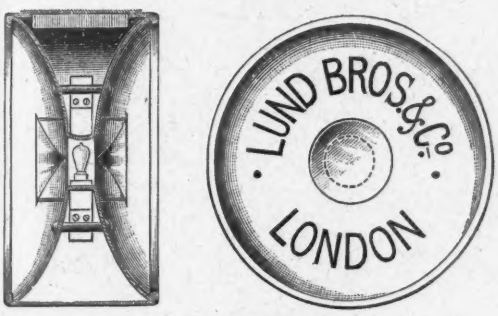

Fig. 7.—Neville Illuminated Sign.

circular sign. For this purpose suitable conical reflectors are fixed in front of the lamp on each side, preventing it from being seen directly, and throwing the letters into strong relief. Rectangular signs can be made on the same principle, with lamps at intervals, and the reflector screen can be fitted with transparent letters; the sign can also be made one-sided, and otherwise modified in various ways, for indoor and outdoor use. It is exceptionally economical, owing to the ingenious method of illumination, and is of inexpensive construction. We understand that it has attained wide popularity in the United States.

"C. & P." Silent Auto-Transformers.

The accompanying illustration shows an auto-transformer made by Messrs. Carney & Pearn, Ltd., of Nutsford Vale Works, Manchester, S.E., in whose designs special attention has been paid

Fig. 8.—"C. & P." Auto-Transformer.

to securing small iron losses and low-voltage drop, and in waterproofing the coils; the insulation is tested with 2,000 volts A.C. Balancers, and two-circuit transformers are also made by the firm.

The Bristol Tramways and Carriage Co., Ltd.—An interim dividend has been declared at the rate of 4 per cent. per annum for the half-year ended June 30th, as last year.

BUSINESS NOTES.

Book Notices.—"Shop Management." By Frederick W. Taylor, M.E., Sc.D. London: Harper & Brothers. Price 5s. net.

"The *Journal* of the Franklin Institute." Vol. CLXXII. No. 1. July, 1911. Philadelphia, Pa.: The Franklin Institute. Price 50 cents.

Bulletins 12 and 14, of the Bureau of Mines. 1911. Washington: U.S. Government Printing Office.

Journal of the Western Society of Engineers. Vol. XVI, No. 6. June, 1911. Chicago: The Society. Price 50 cents.

Transactions of the North-East Coast Institution of Engineers and Shipbuilders. Vol. XXVII. Parts 7 and 8. July, 1911. London: Andrew Reid & Co.

Annuary, Proceedings of the Annual Convention, and Quarterly *Bulletin* of the American Institute of Architects. 1911. Washington: The Institute.

An Ozone Undertaking.—The Ozone Gesellschaft has just been formed in Berlin by the A.E.G. and the Siemens & Halske Co., with a share capital of £100,000, for the purpose of purifying and sterilising water. In addition to the patents of the promoting firms and those of the Felten & Guilleaume Co., the company will take over the patents of the Compagnie l'Ozone and the Otto and De Fries patents for all countries excepting France, the United States and Canada.

Trade Announcements.—The Armorduct Co. have opened a depôt at 32, King Street West, Manchester, where large stocks of their specialities, cables, conduits, metal and carbon-filament lamps and general accessories will be kept for the convenience of their customers in Lancashire, Cheshire, North Wales, &c. Their representative is Mr. H. H. Hopkins.

Midland Electric Corporation for Power Distribution, Ltd.—The registered offices of this company have been removed from 14, Dale Street, Liverpool, to the company's offices at 21, Waterloo Street, Birmingham, to which address all future communications should be sent.

Messrs. Crompton & Co., Ltd., Bombay, announce that owing to the expansion of their business they have moved to larger premises at 35-37, Apollo Street, Bombay. Telegraphic address, "Cromptonco." Telephone No. 557.

The Falcon Iron Works, Ltd., colliery engineers, Oldham, have appointed Messrs. H. Mackay & Co., 4, Southampton Row, W.C., their sole agents in London and District, for the sale of the whole of their specialities, including hauling and winding engines of every description, and other colliery machinery.

The Magnus Engineering Co. announce that they have opened offices at 209, Hackney Road, N.E., and would be glad to receive catalogues and lists from manufacturers, particularly of electrical and mechanical novelties, for inclusion in a retail catalogue.

Annual Holidays.—Engineering and Arc Lamps, Ltd., St. Albans.—The offices and works will be closed from noon Saturday, August 5th, until Wednesday morning, August 9th.

The Crypto Electrical Co., 155, 157 and 159, Bermondsey Street, London.—The works and offices will be closed from noon on Saturday, August 5th, until 8.45 a.m. on Monday, August 14th.

Pope's Electric Lamp Co., Ltd., Hythe Road, Willesden, N.W.—The works will be closed from August 7th to August 12th.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—The Dalston offices and stores will be closed from August 7th to 12th.

Messrs. Gilbert Gilkes & Co., Ltd., Kendal.—The works will be closed from Saturday noon, August 5th, until Monday morning, August 14th.

Catalogues and Lists.—Messrs. Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.—Pamphlet No. B 513, dealing with the Siemens bell signal indicator, a dial instrument showing the number of bell strokes given, for use in connection with shaft winding and haulage in mines, so as to ensure freedom from error; and pamphlet No. A 508, on the "Vibragraph," a new instrument—and the first of its kind—for measuring and recording vibration in definite units. This instrument is very small and light, exceedingly sensitive, and gives permanent photographic records.

Mr G. Braulik, 8, Lambeth Hill, Queen Victoria Street, E.C.—Price list (Section B) of electric bells and accessories—a bulky volume, divided into five sections, and dealing with an extraordinary variety of apparatus. Section I covers all kinds of bells, relays, &c., for indoor and outdoor use, mining and other purposes; Section II relates to indicators of various types; Section III, to pushes, contacts and switches; Section IV to testing instruments, batteries and wiremen's accessories; and Section V gives diagrams of connections. There is also a general index. The great diversity and profusion of patterns contained in this catalogue should render it most useful to contractors, to whom it will be sent on application.

Derome Standard Pulley-Block and Crane Manufacturing Co., 78, Southwark Street, S.E.—Booklet 77, describing, with prices, the "D.S." improved pulley blocks, hand travelling crane, electric travelling pulley block and overhead travelling crane, and hand-controlled and electric runways. The pulley blocks can be had on approval.

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The Falcon Iron Works, Ltd., Oldham.—Leaflets showing electrically-driven and other haulage gears, friction clutches, &c.

Messrs. W. H. Bailey & Co., Ltd., Albion Works, Salford, Manchester.—Catalogue No. 2,710 of "Bailey's power pumps," covering three-throw ram pumps to suit various requirements, some of them electrically driven, as well as double-acting and quadruple-acting ram and piston pumps and special purpose pumps; also No. 1,311 relating to "Köster" air compressors, two-stage and compound, and vacuum pumps.

The Globe Electric Co., Ltd., 11, Farringdon Avenue, E.C.—List No. M60 of "Multax" long-burning flame arc lamps, D.C. and A.C., with deposit-free outer globe and light-distributing deflector. By the patent method of enclosure, the burning hours have been increased by a further 25 per cent.

Messrs. Matthews & Yates, Ltd., Cyclone Works, Swinton, Manchester.—Leaflet describing the "Cyclone" electric fans and exhausters, D.C. and A.C., of the propeller and centrifugal types, and the "Cyclone" D.C. motor made by the firm.

The Union Electric Co., Ltd., Park Street, Southwark, S.E.—List No. 7,023, relating to the "Excello" arc lamp and accessories. The list has been drawn up with particular care to make it complete, and is provided with an index cutting, a feature which the company are introducing into all their arc lamp lists to facilitate reference in their standard binders. Besides various patterns of D.C. and A.C. Excello lamps, the list explains the advantages of dioptric inner globes for lighting large areas evenly, and gives details of reflectors and covers, resistances and chokers, transformers, adapters, winches, &c., with dimension sheets at the end.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, E.C.—Leaflets showing aluminium battery connections, and the process of butt-welding heavy aluminium feeder connections on site, to the specifications of Sir A. B. W. Kennedy.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Catalogue of fans and small motors, including several new lines. Table standard fans, ceiling fans, special cabin fans, and port-hole, chimney-shaft and box blade fans are illustrated and described. Besides ordinary motors, of $\frac{1}{10}$ to $\frac{3}{4}$ B.H.P., a variety of new types of motors for polishing and buffing, &c., motors with vertical spindles, motors for driving looms and gramophones, and small dynamos are listed. The motors are made for D.C., A.C. and polyphase circuits.

Messrs. O'Reilly & Macmillan, Clun House, Surrey Street, W.C.—Card relating to portable electric drilling, reaming and tapping machines, with mechanical overload release, and electric grinders.

Messrs. Perry & Grinsell, Ltd., 1 and 2, Leopold Street, Birmingham.—Leaflet C1, relating to patent petrol-electric sets for country houses, &c., with automatic control—the engine starting when the battery is discharged, and stopping when it is fully charged; E1, about the use of wind power for generating electricity; and R1, describing the "Dallett" patent electric clocks, with dials controlled by a master pendulum.

Messrs. Phœnix Electric Heating Co., 17, Morwell Street, London, W.C.—Catalogue of Phœnix electric heating and cooking apparatus of all kinds, all British made, with increased discounts. The large variety of applications of electric heating here exemplified clearly shows that the demand for, and popular appreciation of, such devices is rapidly growing.

The Electric Construction Co., Ltd., Wolverhampton.—Leaflet B/276 describing the "S.V.P." continuous-current motor, which is provided with a vertical commutator, effecting a saving in cost, and increasing the accessibility of the brushes. The motor is made for $\frac{3}{4}$, 1 and $1\frac{1}{2}$ B.H.P.

Dissolutions and Liquidations.—Under a compulsory winding-up order made against J. G. Childs & Co., Ltd., electrical engineers, Hawthorn Road, Willesden Green, N.W., the first meeting of the creditors and shareholders was held on Tuesday at the Board of Trade Offices, Portugal Street, W.C. Mr. H. E. Burgess, Assistant Official Receiver, reported that he did not propose to enter at any length upon the history of the company, but would shortly issue his observations to the creditors and shareholders. The position of affairs as sworn to by the directors disclosed unsecured liabilities, £20,640, and assets valued at £3,410, but as the latter were subject to a debenture charge of £5,000, there would be absolutely nothing for the unsecured creditors or the shareholders. Mr. H. W. Freshwater (A. C. Palmer & Co.), chartered accountant, had been appointed as Receiver on behalf of the debenture-holders, and that gentleman had valued the assets at between £2,000 and £2,500. He had stated that he was at the present time nearly £1,000 out of pocket on contracts. When he went into possession, he kept the works going in order to complete those contracts which he hoped would bring in a profit. A large loss, however, had ensued, and it really fell on two directors, Mr. T. S. Hill, who had advanced very considerable sums of money, and Mr. H. Turnbull. Together those gentlemen had invested several thousands of pounds, with the result that they had lost the whole of the advances. The company was formed in December, 1901, with an original nominal capital of £20,000, and was registered for the purpose of taking over the business of electrical engineers carried on by Mr. J. G. Childs. To enable a company to be formed that gentleman was joined by Mr. Turnbull, and they were appointed as directors, whilst Mr. Hill subsequently joined the board. The business taken over by the company had been in existence a little over two years, and during that time there had been a profit of £500 odd. It was thought that with more capital the business could be successfully extended, and with that view this company was formed to take over the business for £5,300 in shares and an undertaking for the company to discharge debts existing to the amount of nearly £2,000, thus making the purchase price a little more than £7,000. The trading by the company had throughout resulted in a loss averaging about £2,000 a year, or a total loss of £15,000. The Official Receiver was informed that patents had been taken out by Mr. Childs in respect of a wind turbine. That gentleman went to America to arrange for the flotation of a company to develop the invention in that country, but the negotiations fell through. It was considered that the patents were very valuable, and that something might be received for them, and the Official Receiver would be glad to receive an offer. The creditors decided to leave the liquidation in the hands of the Official Receiver, but in the absence of a quorum the meeting of shareholders was formally adjourned for one week.

Mr. Joseph Wm. Simpson has, owing to the retirement of Mr. Chas. Wm. Stanley, taken over the business of Stanley & Simpson, electricians, 9, Fort Road, and 5, King Street, Margate.

Bankruptcy Proceedings.—Alfred Sitch, electrical engineer, Brecknock Road, Finsbury Park, N.—The first meeting of creditors was held on Wednesday last week, before Mr. Egerton S. Grey, Official Receiver, at the London Bankruptcy Court. It transpired that the debtor's father carried on the business from 1860 until 1887, when he died and left it to his widow. The debtor continued the trading in partnership with his sister, under the style of W. Sitch & Co., until March, 1909, when they formed a company, registered as W. Sitch & Co., Ltd., for the purpose of taking over the business. The debtor received £250 in cash and £2,500 in shares for his interest, and his sister was allotted £750 in debentures. During the existence of the partnership the turnover had averaged from £4,000 to £5,000 per annum, but the company last year sustained heavy losses by reason of bad debts, and the sister ultimately appointed a Receiver under the powers of her debentures. The debtor attributed his present position to liabilities incurred on behalf of the company and to the collapse of the company. He returned his liabilities at £1,339 10s. 3d. (unsecured £239 10s. 3d.), and assets consisting of 2,450 shares in W. Sitch and Co., Ltd., regarded at present as of uncertain value. In the absence of any proposal the case was left in the hands of the Official Receiver, to be wound up in bankruptcy.

William Henry Ridpath (trading as Ridpath & Wells), electrical engineer, 20, Bath Street, Ilkeston, Derby.—The first meeting of creditors in this matter was held at the Official Receiver's offices, 5, Victoria Buildings, London Road, Derby, on Monday last. The statement of affairs showed liabilities amounting to £1,352 and a deficiency of £1,212. The failure was attributed to bad debts, want of capital, and keen and increased local competition. The debtor stated that he had lost £1,100 in 15 months on a business at Bridlington. This sum had been advanced by the debtor's father, and had not been repaid. The debtor started business in 1907 under the style of Ridpath & Wells, having at that time a capital of £11. On a turnover of £830 his average net annual trading profit had been £78. The debtor admitted knowledge of his position since June, 1909. The Official Receiver remains trustee.

John Dennis Carlmark, 402, High Street, West Bromwich, electrical engineer.—Notice is given in the *London Gazette* of intended dividend; last day for receiving proofs, August 12th; A. S. Cully, Official Receiver, Ruskin Chambers, 191, Corporation Street, Birmingham.

LIGHTING and POWER NOTES.

Amersham.—The Chesham E.L. and Power Co., Ltd., has applied to the R.D.C. for consent to erect overhead mains in Station Road for the supply of current.

Barrow.—Messrs. Burt, Boulton & Haywood, of London, have taken over the Devonshire Dock saw mills, at Barrow, and subject to them guaranteeing a return of £100 per annum for a period of five years, it has been decided to provide them with a supply of electricity from the Corporation mains, the extension of which is estimated to cost £913.

The Electricity Committee has authorised the engineer to have a mechanical stoker installed at the electricity works: estimated cost, £200.

Beaconsfield.—The B. of T. has informed the U.D.C. that the promoters of the Uxbridge and District E.L. prov. order have decided not to proceed with the application, which was opposed by the Council.

Beckenham.—The balance-sheet of the U.D.C. electricity undertaking was adopted at the last meeting, and according to the statement of the chairman of the Committee, the actual loss on the year was £842, but to this had to be added a previous debit balance of £251, making a total deficit of £1,093, which, however, they hoped to wipe off in two years' time. The revenue from lighting consumers was higher by £113, but the tramway supply was down by £433, due to the introduction of meters on the cars. There was an item in the accounts of £234 for the new showroom, which had popularised electric lighting at Beckenham and brought a good many customers.

Bispham.—The U.D.C., at the monthly meeting on July 26th, unanimously adopted the recommendation of the Lighting Committee that tenders from the firms specified be accepted for the supply of electrical plant in connection with the Council's proposed electric lighting undertaking.

The U.D.C. has received the sanction of the L.G.B. to the borrowing of £10,800 for the electric lighting scheme.

Bolton.—At a meeting of the Electricity Committee held on July 27th, it was decided that the Finance Committee be requested to apply to the L.G.B. for sanction to borrow £20,000 for electricity purposes. The electrical engineer (Mr. A. A. Day) reported upon the charges made for current for motive power purposes at the cold stores, and the report was approved, the recommendations contained therein to be carried out. Tenders are to be obtained, by advertisement, for the supply of 25,000 tons of coal. The Committee's inspection of the electricity works will take place early in October.

Burnley.—The town clerk has reported to the Electricity Committee that he had received from the L.G.B. sanction to the borrowing of £8,552 for extensions to the electricity plant to be repaid in 17 years, and that the board had deducted from the amount of the loan, £471, representing the difference between the proceeds of the sale of the plant superseded, namely, £380, and the amount of debt outstanding on such plant, £851, and that the sanction was given on the undertaking that whatever might be the total cost of the new plant it would be defrayed to the extent of £471 out of current income, and that the balance only should be charged against the loan.

Canada.—The Prince Rupert Hydro-electric Co. has been incorporated and organised by interests controlling the Western Canada Power Co., of British Columbia. The company has acquired control of the Timpsean Light and Power Co., the Continental Power Co., and the water rights on the Khtada and Falls Rivers, branches of the Skeena River. The water-powers are located about 42 miles from Prince Rupert, and are said to be capable of developing at least 25,000 H.P. The company proposes to develop 1,500 H.P. at once by means of a provisional power plant to supply the immediate demands of Prince Rupert, and to proceed with the construction of a permanent installation capable of supplying 15,000 H.P., to be completed within three years or as soon as the Grand Trunk Pacific Railway shall be completed to the Pacific Coast.—*Electrical World.*

The *Financial News* states that the first two 4,000-H.P. units at the Winnipeg hydro-electric plant at Point du Bois, will be started on August 15th, and three more units, making 20,000 H.P. in all, will be ready by December 1st.

Chester.—The City Council has approved of the Lighting Committee's recommendation :—(1) That Mr. A. C. Hurtzig be requested to report upon the Dee Mills water power scheme for a fee of 100 guineas and his out-of-pocket expenses ; and (2) that in the event of Mr. Hurtzig's report being favourable to the adoption of the scheme, application be made to the L.G.B. for sanction to borrow the entire sum of £10,000, the estimated cost of executing the works.

Continental Notes.—France.—A company has lately been formed in Douai with a capital of £20,000 and the title of La Compagnie Eléctrique du Canton de Marquion (Pas de Calais) to establish a central electric lighting station in the district.

Spain.—La Sociedad Electrica de Sonseca is the title of a new company which has lately been formed in Madrid with a capital of £60,000 to establish a water-power driven station for the supply of electrical energy for lighting and power purposes to the little towns of Sonseca, Ajofrin and Marjalisa, as well as several villages in the district.

Ewell.—The P.C. has decided to ask the B. of T. to consult the ratepayers before giving any licence to a company or Council for supplying electricity to the district. The Epsom U.D.C. is applying for electric supply powers for a portion of the parish.

Fife.—The contractors at Rosyth Naval Base have decided to sub-contract the building of the electric power station for the new Dockyard, and have issued schedules for intending offers. It is understood that the value of this sub-contract, which includes other structures besides the station proper, will amount to nearly £250,000.

Hanley.—The L.G.B. has sanctioned a sum of £13,094 required for cables, but has deferred sanction to the remainder of the £60,000 loan applied for recently by the T.C.

Haslingden.—The L.G.B. has given its sanction to the borrowing by the Corporation of £8,188 for equipment to enable it to supply electricity to consumers in its own area, current being taken in bulk from Accrington for this purpose.

Heston and Isleworth.—The Council has decided, in view of the recent reduction in the price of current to ordinary consumers, to reduce the price to free-wired premises from 5½d. to 5d. per unit.

Hoyland Nether (Yorks.). — Notice having been received from the Electrical Distribution of Yorkshire, Ltd., stating that it is the latter's intention to apply for a provisional order for the urban district, and asking for the Council's consent, the U.D.C. has decided to inquire from three electrical engineers what their charge would be for reporting upon the advisability and cost of an electric supply to the district.

Ilford.—In presenting the annual report of the electricity undertaking for the year ended March 31st last, Mr. Philpot said that the mechanical stokers had acted so efficiently that while 147,000 more units had been generated the cost of coal had only increased by £5 ; £2,000 more had been received from their consumers on the year. The undertaking had been in existence just 10 years. Up to date they had borrowed £181,000, and had repaid £37,000 of capital and £42,000 interest. The chairman of the Committee was congratulated upon the position of the undertaking by several Councillors.

Itchen.—The U.D.C. has decided to take steps to obtain a provisional order under the Electric Lighting Acts, and the Works Committee is empowered to make inquiries as to the cost of installation and plant.

Japan.—By the last Japanese mail we learn that the projectors of the Inawashiro Hydro-Electric Power Co. have at last received a charter from the Japanese Government. The object of the company is to put down a plant to utilise the water power of Lake Inawashiro, about 50 miles from Tokio, for the generation of electrical energy, and to transmit the same to the city for lighting and power purposes. It is stated that the new concern will undertake to supply any quantity of current from 100 H.P., whereas none of the existing companies will supply less than 150 H.P.

Lewes.—The East Sussex C.C. has decided to have the electric light installed at the Lewes Courts at a cost of £128.

Liverpool.—The L.G.B. has given its sanction to the borrowing by the Corporation of £25,000 for meeting expenditure on electricity mains.

London.—In his annual report to the City Corporation, the engineer states that there are 460 electric lamps, compared with 447 12 months before. Of these lamps 32 are centrally hung, while 374 are of the column type, and 54 of the bracket class. The arc lamps total 424, of which 334 are open type, and 90 flame ; and the metallic-filament lamps number 36. The number of gas lamps is stated at 2,659, a decrease of 61 compared with the total in the previous year. The number of defective electric lamps is given as 89, and of gas lamps as 1,763. On 27 occasions the electric lamps were lit during the day on account of fog or unusual darkness at an additional cost of £182. The gas lamps were similarly lit on 34 occasions at an additional cost of £200.

Manchester.—At the quarterly meeting of the Manchester City Justices on Monday, Mr. Bradley, chairman of the Gas Meter Testing Committee, moved that the report which had been presented be passed, which would bring the sellers of electricity under the same conditions as the sellers of gas, so that purchasers of electricity might have an independent authority to test and stamp their meters, and have the same opportunity of seeing that they got fair measure. The City Council were sellers not only of gas but electricity, and the Committee felt there should be the same control with electricity as with gas.

Mr. G. Howorth, chairman of the Electricity Committee, said he was surprised at this, as the Electricity Committee rather prided itself on the way the work was already being done. It had had no complaint as to the accuracy of the meters. At the present time there was no borough in the kingdom where there was a separate plant for the testing of electricity meters, and the Justices had no power to enforce what was proposed.

Mr. Royse said it would be an expensive business to put down electrical-testing apparatus. He thought the probable cost should first be ascertained.

Col. Crook said electricity meters were liable to err in favour of the consumer as against the producer, so that the Corporation, for its own protection, should have a testing station. The question was whether Manchester should show the way to the rest of the country in the testing of electricity meters, by securing legislative powers. He certainly thought an independent authority was desirable.

Mr. Bradley said the public required an independent authority in the event of disputes between them as purchasers of electricity and the Corporation as sellers.

Eventually it was resolved on the motion of the Lord Mayor, seconded by Mr. Alexander Porter, that the report be received and referred to a Committee representing the Justices and Electricity Committee.

Loughborough.—A meeting of the T.C. was held on Monday last, when the town clerk reported that he had received from the L.G.B. sanction to the borrowing of £2,200 for the purposes of the electricity undertaking. The sum of £1,930 was for turbines, &c., repayable in 19 years, and £270 was for instruments and apparatus, repayable in 15 years.

The statistics of the undertaking for June showed a decrease of 4·6 per cent. in the units delivered, and an increase of ·115d. in the cost per unit.

In their estimates for the half-year to March 31st next the Finance Committee included an item of £375, estimated deficiency on the electricity undertaking.

Newcastle Emlyn.—The U.D.C. has entered into an agreement with the electric light company for public lighting in Newcastle Emlyn district and Aberarad for £45 a year.

Paisley.—The treasurer of the T.C., in presenting his annual budget to the Council last week, had again to report a deficiency on the year's working of the electricity department. The actual deficiency this year is £3,540, part of which is the recent arbitration expenses, which amounted to £1,458. To square the deficiency it is proposed to take £2,126 from the reserve fund, which exhausts it, and to give a grant of £1,414 from the gas department. The treasurer, in the course of his statement, said : "We seem to have come very badly out of this arbitration with the tramway company, and, unless something is done to get a flat rate, I see very little prospect of a better service or revenue."

Perthshire.—The owners of mansion houses in the county are going in extensively for electric lighting. The latest convert is Lieutenant Malloy, who since becoming proprietor of the Strone Estate in the beautiful Bridge of Cally district, has carried out many improvements. On Wednesday last week an electrical installation, which lights the mansion house, stables, coach house, and motor house, was switched on. The current is generated by a 5-H.P. engine, and in an adjoining room a battery is provided. Messrs. G. H. Nicoll & Co., Bank Street, Dundee, were the contractors for the work.

Reigate.—On July 25th a L.G.B. inquiry was held into the application of the T.C. for a loan of £8,400 for E.L. purposes, viz.:—Excess expenditure, £2,000; engines and alternators, £4,547; switchboard, £485; consulting engineer's commission, £250; future extensions, £1,118; transformers, £100; mains, £500; house services, £518. There was no opposition.

St. Boswells.—The Electric Supply Corporation, Ltd., has an important scheme on hand in the Scottish Border district. It will erect a power station to supply electricity to St. Boswells, Newtown and Bowden; and is to erect overhead wires from Melrose to Gattonside and Darnick.

Society Islands.—An electric lighting system has just been installed in Papute, the chief city of the Society Islands, in the Pacific Ocean, and according to Consular reports the new lamps are productive of the greatest curiosity among the natives, who come in from miles around to see them. Fifty KW. of generating capacity is installed in the new plant, which is owned by a progressive American resident.—*Electrical World.*

South Africa.—A very successful exhibition of electric cooking and applications of electric power for domestic purposes was one of the features of the Durban and Coast Agricultural Show, held early in July, which was provided by the Durban Corporation. Great interest was shown by the public in the collection of the various appliances for heating and cooking, from a flat iron to a fully-equipped kitchen range, as well as the various means of applying power to sewing machines, carpet sweepers, boot cleaners, knife cleaners, &c.

The demonstrations given in the lecture hall by Mr. John Roberts, borough electrical engineer, were well attended, and it is hoped will result in such applications of electricity being taken up in Durban on a large scale before long, as a cheap tariff for such purposes is now under the consideration of the Council.

Arrangements have been completed for the Ladysmith Corporation to supply electrical energy to the South African Railway Administration at Ladysmith, O.F.S., Junction and the new yard, with a guaranteed consumption of 168,000 units per annum. This will mean that the municipality will run their station during the 24 hours, which has not hitherto been the case.

The Johannesburg T.C. has sanctioned an amended tariff for domestic electric lighting, by which dwelling houses are to be rated on a basis of six units per room per month at 6d. per unit, and the balance at 1½d. per unit. As an alternative, an extra meter with time switch can be fixed at the consumer's cost and energy consumed between 5 p.m. and 11 p.m. charged at 6d. per unit, and during the remaining hours at 1½d. Consumers are warned that the existing circuits will not permit of the simultaneous use of both electric lighting and heating appliances.

Southampton.—Owing to the increased load on the Northam main, the engineer reports that it will be necessary to have this doubled before the winter. The cost for cables for this work is put at £1,156. Mains are to be extended in the Bassett district at a cost of £155. Sanction has been received from the L.G.B. for the borrowing of £5,700 for enlarging the trunk mains at Portswood and Shirley. A report has been received to the effect that the last engine which was brought from the Back-of-the-Walls was still running non-condensing; the engineer suggested that he should be allowed to obtain prices for a suitable condenser for the engine at an approximate cost of £710 and purchase the necessary air pump. The cost of this would amount to about £262. The Committee agreed. A Sub-Committee has had under consideration the question of increasing the staff on the commercial side of the electricity undertaking, thus following in line with other large undertakings. It was no use, the engineer and manager stated, expecting business to come in without asking for it, and therefore the Council should inaugurate a business-getting staff. It was no good getting a junior, because while they were teaching him his work, the Council's competitors were going ahead fast, and unless they offered a commencing salary of at least £4 10s. a week, they would not get a good man. He had communicated with four undertakings in the country (outside London) with regard to what they were doing in this matter, with the following results:—(1) Sales manager, £425 per annum, plus bonus; assistant manager, £260 per annum; constructional engineer (outside), £4 10s. per week; assistant engineer, £2 10s. per week; 11 outside representatives (canvassers). (2) Total salaries paid in business-getting department, £900, no details given. (3) Sales manager, £300 per annum; total salaries paid in this department, £1,784; six outside representatives (canvassers) employed. (4) Total salaries paid, £202 per annum. (This is quite a small undertaking.) In accordance with the engineer's suggestions, the Committee has interviewed Mr. H. Bennett from the Westminster Electric Supply Co., for the position of head of the business-development department of the electricity undertaking, and has decided to appoint him at a salary of £225 per annum, rising at the end of 12 months to £250 per annum, subject to his services being to the satisfaction of the Committee. His designation is to be "commercial engineer."

Tunbridge Wells.—The T.C. has decided to supply current to the General Hospital for the X-ray and Finsen apparatus at the usual power rate of 2½d. per unit.

U.S.A.—Figures given in the recent annual report of the department of electricity of Chicago show that the total number of public street lamps in service on December 31st, 1910, was 37,994. Of these, 12,366 were municipal electric arc lamps; 893, rented arc lamps; 11,990, gas-mantle lamps; 5,426, gas flat-flame lamps and 7,319, gasoline lamps. The cost of rented arc lamps is $75 a year, municipal arc lamps $61.95 a year, mantle gas lamps $18.91, open-flame gas lamps $15.41, and gasoline lamps $26.40. There are 763 isolated electric plants in that city supplying 19,670 arc lamps and 788,034 incandescent lamps.—*Electrical World.*

The Indiana Steel Co., has just completed at its Gary plant, the first section of the coke oven equipment, all the auxiliary operations of which are performed by electric motor; coincident with the above, the duplication of the gas engine power house (which was described in this journal) has been taken in hand.

Wednesbury.—Application is to be made to the L.G.B. for sanction to borrow £333 in respect of extensions on small mains.

West Hartlepool.—Waste Heat Inquiry.—The inquiry which was commenced in the latter part of February into the application of the Corporation for sanction to borrow £38,651 for the purpose of establishing a waste heat and exhaust steam electricity supply, was concluded on July 21st, before Mr. H. R. Hooper, representing the L.G.B. The Corporation proposed to enter into an arrangement with the Seaton Carew Iron Co. for the utilisation of its exhaust steam and waste heat, and a new station is to be erected near the company's works. When the proceedings were re-opened on the 20th inst., Mr. W. B. Clode, K.C., represented the Corporation and Mr. Tyrrell, K.C., appeared for the Cleveland and Durham Electric Power Co. The hearing of evidence was continued.

Capt. Sankey gave evidence as to various tests he had made at the Seaton Carew Ironworks. These tests indicated that there were over 50,000 lb. of exhaust steam per hour now going into the air. Different tests gave actual calculations of 51,600 lb., 53,850 lb. and 56,100 lb. The full-load requirements of the turbine to which the steam would be conveyed, were 48,400 lb. per hour, average figures. He added that the agreement between the Corporation and the company was for 30 years.

Mr. J. F. C. Snell said the Corporation were to take all the waste gas or all the waste heat in any other form—whether from the coke ovens or the blast furnaces, under a certain guarantee to be given to the Corporation. One clause of the agreement provided that in the event of any catastrophe and the company closing down, and the Corporation being driven to supply the turbines by coal-fired boilers, during that period the company would agree to pay to the Corporation 70 per cent. of the actual cost of their coal. That was an extremely important guarantee.—The Inspector: Supposing the Seaton Ironworks do not stop working, but at the end of 30 years they tell the Corporation to go. What is the position of the Corporation then?—The town clerk stated that the lease was one for 30 years, and in the absence of terms being arranged the Corporation would have to comply.—Mr. Snell said that if, with all these guarantees, the Corporation were not going to be in a position of safety and security to maintain a proper supply, under the terms of the Cleveland and Durham Co.'s Act they could fall back upon the company, and the company would be bound to supply them.

When the proceedings were resumed on the 21st ult., Mr. Clode stated that the N.E. Railway Co. had withdrawn their opposition to the proposals, and he produced a letter to that effect. This closed the case for the Corporation.

Mr. Charles H. Merz, consulting engineer to the Cleveland and Durham Co., said there were six waste heat stations in existence, and seven more in course of construction. A stand-by plant with coal always burning under the boilers was a necessary, complementary, part of a waste heat station. The capital expenditure on a combined system of waste heat plant and stand-by plant was necessarily very much higher per kilowatt than the capital expenditure for a coal fired plant, because to a certain degree the machinery must be in duplicate. He described the Corporation's scheme as unsound and unworkable. On the other hand, referring to the offers that the Cleveland and Durham Power Co. had made to the Corporation, he stated that if the company took over the Seaton Iron Co.'s supply and joined it on to their general supply, they could supply the Corporation with current at a lower price than the Corporation could produce it themselves. In the course of a long examination by Mr. Clode, witness said that the Power Co. were not bound to give a supply to the Corporation at a moment's notice.

Mr. Greville Jones, works manager at Messrs. Bell Bros. and Messrs. Dorman, Long's works at Port Clarence, described in detail the various stoppages to which blast furnaces were liable, and stated that for longer or shorter periods the supply of waste gas could not be relied upon.

Mr. H. E. Wright, works manager at Messrs. Sir B. Samuelson and Co.'s works at Middlesbrough, gave similar evidence.

Mr. Tyrrell, in his address on behalf of the power company, said there were three courses open to the Corporation. One was to put down their own coal-fired plant, but that had apparently been ruled out by both sides. That left two alternatives, either to take up the scheme now proposed, or to go to the company. If the waste steam at the Seaton Carew Iron Co.'s works was to be used to the best effect, it ought to be used with a constant load. The position of the Corporation was that they were entitled to neglect all the waste over and above the quantity they

required. The Corporation would get a supply better suited to their purpose by letting someone else take that steam and use it as the power company could use it with a constant load, giving a varied, but always sufficient, supply for the purposes for which they required it. If the Corporation insisted upon setting up this plant, they would run a risk which no Corporation had ever run before, of establishing a business that might never be satisfactory. It would be waste of money to run the risk, and doing the power company a great injury.

Mr. Clode, in concluding his speech, on behalf of the Corporation, said that temporary interruptions from various causes were met by the system under which the Corporation would work. Coal firing and gas firing already in existence at these boilers, could be resorted to, and was resorted to at present.—The Inspector: One must not lose sight of the future. It is every bit as much important as the present day. Indeed, the conditions of the future are far more important than those of to-day.—Mr. Clode said that assuming that coal-firing were abolished, and gas engines were put in, he would have a larger proportion of gas. The Corporation were properly safeguarded in the agreement against every contingency that might arise.—The inquiry then terminated.

Worthing.—A public inquiry was conducted by Mr. R. H. Hooper, on behalf of the L.G.B., on Friday last, respecting the application by the T.C. for sanction to borrow £4,950 for suggested extensions of the buildings and generating plant at the Corporation electricity works. The town clerk (Mr. W. Verrall) explained the proposed extensions were necessitated by the growth of the borough, the population of which had shown an increase of 10,385 during the past ten years, while the assessable value had increased by £65,304. The last generator was put in in 1903, and the total capacity of the four now in use was 538 KW., of which 500 KW. were available for supply purposes. The maximum demand last winter was 412 KW., and this had since risen to 423, 63 additional consumers having been connected with the mains during the last four months. It was proposed to put down two new generators, each of 125 KW. capacity, and driven by Diesel oil engines, and it was anticipated that with these additions the plant would be adequate for the next five years. Technical evidence in support of the application was given by the resident electrical engineer, and it was stated that the proposals had received the complete approval of Mr. Snell, of Westminster. In the course of some comments on the present position of the undertaking, the Inspector remarked that the charges for public lighting seemed rather stiff, but during the last four or five years there had not been any call upon the rates, and he saw they had a reserve of £3,327, which was a sound balance to have on the credit side of the undertaking. Mr. E. W. Bennet wished to get a condition inserted for the provision of a smoke consuming apparatus, but expressed his willingness to withdraw his opposition on receiving an assurance that every attempt would be made to abate any nuisance from the smoke. The only other opposition to the proposed loan came from Councillor Cook, who criticised the street lighting as a wasteful extravagance, urging that public lighting should be done by an up-to-date system of gas lighting; but the chairman of the Electricity Committee stated that so far, Councillor Cook had failed to make any impression on the T.C. in favour of any alteration in the system of public lighting.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Corporation tramway department shows, for the year to May 31st last, the highest revenue in the history of the undertaking. The income was £73,470, compared with £71,121. The total revenue, remarks Mr. Pilcher, the general manager, in his report, had been practically stationary for the previous four years, and it is very gratifying to see a substantial increase this year. This increase, the manager says, may be attributed to the weather, the winter having been exceptionally mild, there being practically no snow or severe frost. The working expenses amounted to £39,674, a decrease of £776 compared with the previous year.

Algeria.—The construction of an electric tramway between the town of Oran and El Ancor has been decided upon.

Australia.—The acting Victorian Premier is stated to have promised to submit to Parliament a definite electrification scheme for the Melbourne suburban railways.

Birmingham.—On the recommendation of the Tramways Committee, the City Council has decided to enter into an agreement with the City of Birmingham Tramway Co., Ltd., for the purchase for £151,500 of the whole of the interests of the company and of the British Electric Traction Co., Ltd., in the tramways in Aston Manor, King's Norton and Northfield, and Yardley, together with the lands, rolling stock, generating stations, &c.

Continental Notes.—AUSTRIA.—The question of the transformation of the Vienna City Railway to electric traction, which has been under consideration for a number of years past, has now entered upon a new stage inasmuch as it has just been decided to invite tenders from home and foreign firms for the execution of the work, which is estimated to involve an expenditure of from £8,000,000 to £12,000,000. Built over 20 years ago as a circle line round the enlarged city, and more for strategic purposes than for those of meeting the general needs of the traffic, the Vienna City Railway has never been successful, and the traffic has decreased since the Vienna tramways were converted to electric traction. The railway belongs, although not in equal shares, to the State, the Province of Lower Austria, and the City of Vienna, and the working results not only do not pay the whole of the interest on the invested capital of £5,600,000, but they also leave an annual deficit of £60,000, which falls upon the State Railway Administration, which undertakes the working of the railway. The Traffic Commission, which is composed of representatives of the three authorities mentioned, including the Minister for Railways, has now conceived the idea that the reorganisation of the railway might be carried out by the introduction of electric traction and the construction of three or four new lines of the underground class, and that it might be left to private enterprise to undertake the work and also the future operation of the modernised and extended railway. It would seem as if the disposition exists, owing to the unremunerativeness of the railway and the complications which would arise from any attempt to electrify the undertaking under existing conditions of triple ownership, to make a free present of the railway to any firm or group which would agree to bring an electrical scheme to a successful conclusion. The actual electrical work would only represent a portion of the expenditure previously mentioned, as the major portion of the outlay would be for costly tunnel and other works in connection with the proposed new underground lines. Although the project is to be thrown open to foreign competition, it has to be remembered that the tendency in Austria is to give preference to native firms for the execution of public works. In the present case three companies come into consideration—namely, the Austrian Siemens-Schuckert Works, the Austrian A.E.G.-Union Co. and the Austrian branch of Ganz & Co., whilst Kolben & Co., of Prague, and Fr. Krizik, of Prague, have also carried out noteworthy electric railway work, and the firm of Stern & Haffert, of Gmunden, has received the order for the conversion of the State line—Attnang-Ischl-Steinach—to electric traction. Nevertheless, it is said that the Berlin A.E.G. and the Siemens-Schuckert Works intend to take an interest in the Vienna scheme in conjunction with their branch companies in Vienna. A Vienna correspondent, in commenting on the conversion project, remarks that electrical companies will doubtless be found ready to undertake the work in association with their friendly banks, if the Traffic Commission is able to offer a guarantee of the interest on the capital to be invested, but the triple composition of the Commission excludes this possibility. Many schemes will be submitted for the carrying out of the work. The less important companies will underbid the leading firms in order to secure the business, until they perceive that they could not undertake the work according to the original estimates and with the capital at their disposal, whilst the large firms will then decline to accept the risk at the minimum prices. It is, therefore, concluded that in this way the negotiations will be protracted over a long period, and Vienna continue to be deprived of improved traffic facilities until the remote future.

ITALY.—It is announced from Rome that a provisional agreement has just been signed in relation to the formation of a company for the construction and working of a high-speed electric railway from Rome to the seaside town of Ostia. The capital has been temporarily fixed at £800,000, and those interested are declared to be the Paris Metropolitan Railway Co. and another French group. It is proposed to build the railway underground from the centre of Rome in the Piazza Venezia to the Porta San Paolo, in order to be able to work the line at the high speed in contemplation. A second underground section is to proceed under the Borso Umberto and the Piazza del Popolo, and thence form a connection along the Tiber with the Porta Salaria. The promoters of the company have concluded an agreement with the City of Rome whereby the latter will place land at the company's disposal, and also furnish a supply of power for working the railway. A period of two years is to be occupied in constructing the line to Ostia, and three years for the underground sections in the city.

La Société del Tramvie di Mestre has secured the concession for the construction and working of electric tramways between Mestre and Carpenedo, and between Mestre and Treviso.

SPAIN.—La Société des Tramways Electriques en Castille, is the name of a new company which has just been formed in Brussels with a capital of £60,000 to acquire and work the electric tramway system in the town of Santander, and also the steam tramway between the town and the sea coast, a distance of about 4½ miles; it is proposed to convert the latter to electric traction.

SWITZERLAND.—The labours of the Swiss State Committee of Inquiry into electric railway working are proceeding so rapidly that a report will shortly be published dealing chiefly with the proposed conversion of the St. Gothard Railway. A Sub-Committee has investigated the suitability of the various systems of working from an economic point of view, and has decided in favour of the superiority of the single-phase method at 15 periods. A scheme has been worked out on this basis, and a second sub-committee has prepared a project for hydro-electric works. It is considered that the first line upon which electric traction will be introduced will be that from Ersefeld to Biasca, and the expenditure is estimated at £800,000.

RUSSIA.—According to a Russian newspaper, a company at Krestowskipor has submitted to the City of Moscow, a scheme for the construction of an electric railway with a length of 46 miles to Lossinostrowkaja and Puschkino. The expenditure is estimated at £867,000, and the company proposes to raise £240,000 in shares, and £820,000 in debentures. A second railway, with a length of 83 miles, is projected in the Crimea. It is to extend from Sebastopol *via* Jalta to Aluschta, and to have a branch to Balaclava. The outlay is computed at £2,815,000, and shares of £590,000, and debentures of £2,950,000, would be issued for the purpose.

Egypt.—According to the *Daily Telegraph*, the Cairo tramway employés struck work on Sunday. Two thousand eight hundred men are at present affected, and the entire service is suspended, to the great inconvenience of the public. The company declares it will make no further concession.

Halifax.—The Tramways Committee proposes to erect shelters at Boothtown, West End, Stump Cross, Bradshaw, near St. Jude's Church, and at Southowram. It is intended that the work required in connection with the laying of tramways in Orange Street, between Broad Street and Corporation Street, in Northgate, between Woolshaps and Victoria Street East, and in George Street, should be proceeded with as soon as Parliamentary powers are obtained. The construction of the lines is estimated to cost £2,481, apportioned as follows:—Orange Street, £840; Northgate, £684; and George Street, £957.

Haslingden.—The Union Assessment Committee has declined to join the Accrington Corporation in asking the umpire in the tramway assessment inquiry to give the basis of his award, which was not satisfactory to Accrington. The Haslingden Committee regard the umpire's award as binding and final.

Liverpool.—An open-air meeting, attended by 700 drivers and conductors in the employ of the Corporation Tramways department, was held at Walton on July 27th, to protest against any outside interference in regard to the question of forming a trade union. A resolution was carried thanking Mr. Mallins (general manager) and the Tramways Committee for the concessions that had been made in the grant of merit pay to the great bulk of the drivers and conductors in the service. It was also stated that the employés wished to assure them of their continued loyalty to the department, but to say that they did not desire, and would not tolerate, any interference from outside which would tend to disturb the relations that had so long existed between the Committee and its employés.

London.—L.C.C.—The annual accounts and report of the chief officer for 1910-11 have now been prepared. The street mileage of the tramways amounted to 126 (electric) and 17 (horse) miles, which, with the exception of about 3 miles, is worked entirely by the Council. The net capital debt on the undertaking at March, was £9,465,499. The surplus on the working of the electric lines amounted to £914,418, which was reduced to £895,048 by the deficiency on the horse lines. Interest and redemption charges absorbed £656,991, and after meeting other expenses, a surplus of £232,727 remained for disposal. From this the renewals fund benefitted to the extent of £129,228 (at the rate of ¾d. per car-mile), bringing that fund up to £527,264. The balance, a sum of £103,498, was transferred to the general reserve fund, which now amounts to £176,845. The total operating expenses for electric traction were £1,235,821, including £22,993 for special charges, or 6·48d. a car-mile run, as compared with 6·42d. a car-mile in 1909-10. The total working expenses in connection with horse traction amounted to £101,948, or 10·38d. a car-mile run. The passenger traffic receipts in respect of electric traction amounted to £2,096,913, or 11·00d. a car-mile run, as compared with 11·21d. for 1909-10. From lines operated by horse traction the traffic receipts amounted to £80,580, or 8·20d. a car-mile run, as compared with 8·14d. for 1909-10. The Committee adds that in connection with the decrease a car-mile, it must be borne in mind that the most remunerative routes were the first to be reconstructed. During the past year less remunerative lines have been electrified; moreover, the weather during the summer and autumn of 1910 was very wet and cold, while the increasing number of workmen carried each year contributes to the falling off in the receipts a car-mile run. Considerable loss was sustained during the reconstruction of horse lines for electric traction, as sections of some of the routes had to be closed, and this disorganised the traffic on several important routes. The total number of passengers carried and car-miles run during the year were as follows:—

	Electric Traction.	*Horse traction.*	*Total.*
No. of passengers	482,296,935	22,418,391	504,715,326
No. of car-miles run	45,744,066	2,357,504	48,101,570

As satisfactory terms could not be arranged for the purchase of the London portion of the London United Tramways by the L.C.C., the B. of T. has appointed Mr. R. Elliot Cooper as arbitrator in the case. The Board is also to nominate an arbitrator to determine the purchase price of the Metropolitan Electric Tramways in Seven Sisters Road between Stroud Green Road and Green Lanes.

A new agreement is to be entered into with the Leyton U.D.C. for through-running between Epping Forest and London tramway termini, *viâ* Lea Bridge Road and Mare Street.

A supplemental agreement is also to be entered into with West Ham Corporation and Leyton U.D.C. regarding the running of cars by the three authorities in Leytonstone Road.

Mirfield.—The U.D.C. has decided not to take any further action respecting a proposal to adopt the railless traction system for the town.

Oakworth (near Keighley).—Some time ago, a deputation from the Keighley Corporation came before the Council in reference to the proposal of that Corporation to apply for Parliamentary powers for the running of motor-omnibuses and rail-less trolley tramways. The U.D.C. has now received a communication from the town clerk of Keighley, stating that it is proposed to run along Slaymaker Lane, and asking for the formal consent of the authority. The Council has decided to oppose the application.

Oldham.—A mass meeting of the tramway drivers and conductors has been held, at which a number of grievances were stated, including the alleged importing of inspectors and officials into the town, when equally capable local men are refused such positions. The men have issued an ultimatum to the manager, calling upon him to dispense with the services of the imported officials within 14 days. The men also complain of having to lose their work when "warned for office," and having no notification of the nature of the complaint. They contend that no man ought to be discharged by letter, and that he ought to be confronted with the complainant, and be allowed time to secure evidence. A deputation is to wait upon the Tramways Committee at an early date,

South Africa.—The Johannesburg tramway receipts for last June amounted to £24,921 against £22,346 for June in the previous year. While for the whole 12 months the fares have yielded £312,539, compared with £282,731 for the preceding year. During the year 26,632,015 passengers were carried, or 5,305,000 in excess of the figure for the previous year.

TELEGRAPH and TELEPHONE NOTES.

Municipal Telephony.—The National Chamber of Trade has been in correspondence with the Postmaster-General, advocating municipal telephone services, and asking for a committee to discuss this question and the method of charging for telephones.

A Telegraph Trust in the United States.—The Postal Telegraph Co., which is the American landline system of the Commercial Cable Co., has written an open letter to the Attorney-General of Texas, setting forth that a monopoly and combination, in violation of the Anti-Trust Acts of that State, has been brought about by the Western Union Telegraph Co. and American Telephone and Telegraph Co. and their subsidiary companies, with the effect that 83 cities and towns in Texas and surrounding States, each having more than 1,000 population, have been cut off from telegraph competition, besides a much larger number of smaller towns; the Postal Co. is building into that territory as fast as the lines can be constructed. This letter is in response to an inquiry by the Attorney-General, who is investigating the subject in accordance with a resolution of the Legislature of Texas. The letter states that "we can maintain offices in all of your chief cities and towns, and intend to do so, and you may rely upon it that when we open offices in those cities and towns they will stay open, and will not pass under the control of the Bell Co. or the Western Union. . . . The American Telephone and Telegraph Co. is apparently seeking an absolute monopoly in ocean cables, landline telegraph and telephone communication in the United States."

Telegraphs and the Hot Weather.—The extremely hot weather experienced this summer, accompanied by severe thunderstorms, has considerably affected the telegraph systems on the Continent, causing long delays and congestion of the wires that remain open.

Wireless Telegraphy.—A wireless station is being installed by the French at Fez in Morocco, and another at Taurirt; the former will be able to communicate with Paris by way of the latter, and on to Paris by wire, or direct to Oran and thence to Paris entirely by wireless.

A contract has been entered into by the Marconi Wireless Telegraph Co., Ltd., and the Italian Government for the erection by the company of a 60-KW. station in the vicinity of Rome. The building, masts and material are being supplied by Marconi's Wireless Telegraph Co., Ltd., the erection of the masts being carried out through the intermediary of the Italian Agency. Six towers in iron and wood of the Coltano type are being erected, two each being 75 m. high and the remaining four each of 45 m. in height. These will support a multiple-wire T aerial of a total length of 360 m. The surface occupied by the aerial will be about 14,000 sq. m. The Italian Government are erecting the building, which will contain engine, power, battery and operating rooms, stores, waiting and staff rooms and the necessary adjuncts. In the engine room, which will have a floor space of 32 ft. × 25 ft., there will be installed duplicate 50-B.H.P. Diesel oil engines, each driving by means of a belt, a 30-KW. continuous-current dynamo. Two 32-KW. low-frequency inductances will be provided for regulating the frequency of the discharge circuit to the value necessary for the number of sparks adopted, and, in addition, two 32-KW. high-pressure transformers will be installed to transform the alternating current by the group of generators to the required voltage for the condensers. The receiving apparatus will consist of a valve receiver adapted to receive all waves comprised between 2,650 and 6,500 m. A magnetic detector will also be furnished. The station is to test to Poldhu and will have a normal power of 32 KW. and overload up to 100 KW.—*The Marconigraph.*

Last week wireless messages were dispatched from an aeroplane at Rambouillet to the Eiffel Tower at Paris, a distance of 31 miles. The apparatus carried on the aeroplane weighed about 46 lb.

It is stated that negotiations are proceeding with a view to the formation of a Russo-French company for wireless telegraphy in St. Peterburg, the share capital being put at £160,000. At first wireless telegraphy in Russia, which is largely employed in the Russian navy, only concerned the Russian Siemens & Halske Co.

Subsequently a competitor was formed under the title of the Russian Wireless Telegraph and Telephone Co. Although supported by the Government, the latter concluded the first financial year with a large loss, and the year 1910 has also ended with a loss of £13,000 on a share capital of £120,000.

According to a Berlin newspaper, the shares in the C. Lorenz Telegraph Co. have recently attracted greater attention on the Berlin Stock Exchange. The cause of the advance in quotations was to be found in a rumour that the Marconi Co. proposed to acquire patents from the High-Frequency Machine Co., which is a subsidiary of the Lorenz Co., but which declined to give any information on the matter when asked to do so. On the other hand, the Berlin newspaper learns from circles having relations with the Marconi Co. that the latter has no intention of obtaining any kind of patents from the High-Frequency Co., but proposes to enter into keen competition with the latter. The Marconi Co., it is added, also contemplates placing on the market a machine based upon the same principles in the near future.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—Tenders for four double-deck cars. Drawings and specifications from R. Stuart Pilcher, general manager.

Australia.—Victoria.—August 9th. 530 A.C. meters, 496 D.C. meters and 133 maximum-demand indicators, for the Melbourne City Council. See "Official Notices" July 28th.

September 5th.—(*a*) 10,000 protectors and (*b*) sundries, for the P.M.G.'s Department. See "Official Notices" July 28th.

South Australia.—August 23rd. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" July 7th.

August 30th. P.M.G. Insulators, copper wire and sleeves. See "Official Notices" July 14th.

New South Wales.—Telephone, telegraph and electric light material for a year, and a dessiccating plant for the P.M.G.'s Department. See "Official Notices" July 28th.

Queensland.—August 23rd. Letter-box fronts, for the P.M.G.'s Department. See "Official Notices" June 30th.

Blackburn.—August 12th. Steam coal for a year, for the Corporation electricity department. P. P. Wheelwright, engineer and manager, Jubilee Street Works.

Bolton.—The Electricity Committee of the T.C. desires tenders for 25,000 tons of coal.

Brazil.—August 21st. Electric goods lift and electric crane for the Naval depôt on the Island of Cobras. Local representation. Deposit £33. Inspectoria de Engenharia Naval, Ministerio da Marinha, Rio de Janeiro.—*Board of Trade Journal.*

September 25th.—All electric lighting fittings, fans, lamps, insulated conductors, &c., required in connection with the equipment of the new Postal Telegraph building in Port Alegre with electric light. Value about £3,100. Local representation. Deposit about £33. Directoria Geral do Expediente, Ministerio da Viacão e Obras Publicas, Rio de Janeiro.—*Board of Trade Journal.*

Croydon.—The Board of Guardians has instructed the borough surveyor, with the assistance of the borough electrical engineer, to prepare a specification, upon which tenders could be invited, with a complete estimate of the cost in detail of electrifying the lifts at the Waingates Children's Homes. The borough electrical engineer puts the cost at £250 per lift.

Erdington (near Birmingham).—Construction of 1¼ miles of double-track tramway. H. H. Humphries, engineer to the Council, Council House, Erdington.

Farnham.—August 16th. Two high-speed Diesel oil engines coupled to two 90-KW. alternators, with direct-coupled exciters, piping, tanks, overhead traveller, &c., and main H.T. switchboard, for the Farnham Gas & Electricity Co. See "Official Notices" July 21st.

Frodingham.—August 11th. Poles, lamps, wires and switches for street lighting, for the Brumby and Frodingham U.D.C. See "Official Notices" July 21st.

New Zealand.—August 14th. Tenders are invited by the Post and Telegraph Department for the supply and delivery of 36 magneto switchboards. A copy of the specification, &c., may be seen by British makers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Roumania.—The municipal authorities of Slatina are inviting tenders until the 10th inst. for the concession for the electric lighting of the town.

Russia.—The T.C. of Stavropol (Caucasus) is open to receive tenders for the installation and working of an electric tramway service. The last day of submission is August 14th.

Salisbury.—Electric lighting of the Salisbury and District Joint Isolation Hospital. See "Official Notices" July 28th.

Turkey.—Tenders are invited for concessions (1) to establish a public water service; and (2) an electric installation for lighting and traction purposes in the city of Jerusalem and its suburbs. Guarantees, 1,000 and 2,000 £T respectively.

Warrington.—August 9th. Motor-driven induced-draught fan, for the Corporation. See "Official Notices" July 28th.

West Ham.—August 31st. Water-tube boilers, coal-handling and discharging plant, 5,000-KW. turbo-alternator, with condensing plant, river service pipework, centrifugal pumps, and one 750-KW. converter, for the Corporation. See "Official Notices" to-day.

Whalley.—Electrical plant, &c., for the new asylum. The Lancs. Asylums Board will shortly invite tenders for the above from a selected number of firms. See "Official Notices" July 28th.

Wolverhampton.—Buildings and plant for a 1,000-KW., 440-volt direct-current generating station, for the Knowles Oxygen Co., Ltd. See "Official Notices" July 14th.

The Corporation Electricity Committee invites tenders for a 400-KW. rotary converter and switchgear, at an estimated cost of £1,600, for the purposes of the supply of energy to the Knowles Oxygen Co., Ltd.

CLOSED.

Aberdeen.—Mr. John F. Anderson, Bridge Street, Aberdeen, has secured the contract for electrical work in connection with the temporary buildings to be erected at Robert Gordon's Technical College.

Australian Contracts.—New South Wales.—Postmaster General's Department.—Noyes Bros. (Sydney) Ltd., 46 tons steel stranded wires, at £16 4s. 3d. per ton.

Victoria.—Postmaster-General's Department.

British Insulated and Helsby Cables, Ltd.—366 strips of jacks, 160 coils 160 relays, and 8 terminal blocks.
Richard Johnson, Clapham & Morris, Ltd.—13½ tons galvanised iron wire, £154 12s.
Australian Metal Co.—22 miles telegraph cable, in lengths of 440 yards, £5,946; 108 miles telephone cable, £17,630 10s. 6d.

Small Arms Factory, Lithgow (N.S.W.).—Supply and installation of electric light, wiring lamps, &c.—Lawrence & Hanson, £494; electric light cables, Noyes Bros, Ltd, £728.

Barnes.—The parish church of Barnes has decided to install the electric light, with dimming arrangements for use during the sermon, and Messrs. T. L. Hellyar & Sons have been entrusted with the carrying-out of the contract.

Bennis Stokers.—Messrs. Ed. Bennis & Co., Ltd., Little Hulton, Bolton, have recently received the following orders from electricity works:—Coventry Corporation—One "Bennis" coal-gathering conveyor (duplicate of the existing barge conveyor); Dudley Corporation—Two "Bennis" stokers, self-cleaning compressed-air furnaces (repeat order); Pembroke (Ireland) U.D.C.—Two "Bennis" high-pressure compressed-air furnaces (repeat order); Barnsley Corporation—Two pairs of "Bennis" chain-grate stokers; Cleckheaton U.D.C.—Four "Bennis" stokers and self-cleaning compressed-air furnaces.

Bispham (near Blackpool).—The U.D.C. has accepted the following tenders:—

Engines and dynamos.—National Gas Engine Co., Ltd., Ashton-under-Lyne (with a Bruce-Peebles dynamo).
Switchboard, balancers and boosters.—Kelvin & James White, Ltd., Glasgow.
Storage battery.—Premier Accumulator Co., Ltd., Northampton.
Section mains.—British Insulated & Helsby Cables, Ltd., Prescot.

Burnley.—The contract for the electric lighting at the Victoria Hospital extension has been secured by Mr. R. B. Beattie, St. James' Street, Burnley.

Canada.—The British Electrical Plant Co. has received the contract for pumping plant in connection with the Montreal (Quebec) filtration plant, the price being $10,000.

Denmark.—Notwithstanding protection and keen competition on the part of local firms, Messrs. Wm. Geipel & Co. have secured a contract for 68 Geipel steam traps for the new Copenhagen Hospital.

Eccles.—The T.C. has accepted the tender of Messrs. Korting Bros., Ltd., for the supply and delivery of a motor-driven centrifugal pump, at £185, for the electricity works.

France.—The French Post and Telegraph authorities in Paris have just given out contracts as follows:—La Société d'Electro-Métallurgique de Dives, 50 tons of bi-metallic wire 2 mm. dia., at 1,839 francs per ton; La Compagnie Française du Bimétal of Paris,

75 tons ditto, at 1,840 francs per ton, 75 tons ditto, at 1,837½ francs per ton, and 40 tons ditto, 3 mm. dia., at 1,895 francs per ton; and La Compagnie Française des Métaux, of Paris, 40 tons ditto, at 1,898 francs per ton.

Gloucester.—The Electricity Committee of the T.C. has accepted the tender of Messrs. Drysdale & Co., Ltd., for a circulating pump for the condensing plant, at £135.

Hendon.—The D.C. has had under consideration estimates for the lighting of the hospital by electricity and gas, and has accepted that of Messrs. C. Suckling & Co., at £65, for electricity.

London.—L.C.C.—The Fire Brigade Committee has received the following (fresh) tenders for electric wiring and fittings for the North Kensington fire station:—

E. Lawrance & Sons, Ltd.	(accepted)	£157
G. Weston & Sons, Ltd.		160
Malcolm & Allan, Ltd.		168
E. Newbald & Co.		194
Tredegar & Co.		221
Chief Engineer's estimate		160

Apparatus is to be installed at four stations for charging the batteries of the electrically-driven escape vans, at an estimated cost of £200.

The Highways Committee recommends the acceptance of the tender of Messrs. Kirk & Randall (£18,140) for the road work and platelaying for the Brixton Road-Herne Hill trolley tramways, and of the tender of John Mowlem & Co., Ltd. (£66,646), for similar work in connection with conduit tramways in Seven Sisters Road and Green Lanes. In connection with the above and other tramways, the Committee recommends that arrangements be made with Hadfield's Steel Foundry Co., Ltd., for the supply of special trackwork at a cost not exceeding £16,700. The same firm are to supply special work for junctions at St. George's Circus and in Kennington Road.

The tender of the British Westinghouse Co., at £6,390, for the supply of standard type controllers, electrical interlocking gear and cables for 100 double-deck cars, is recommended for acceptance.

For the third section of the central car depôt, machine tools are to be obtained from Messrs. Buck & Hickman, £1,565; and Pollock and Macnab, £524.

The Highways Committee has considered tenders received for (*a*) 6,000 steel driving-wheel tires, and (*b*) 4,000 steel pony-wheel tires, and recommends acceptance of the tenders of Messrs. John Batt & Co. (London), Ltd., for driving-wheel tires at 15s. 8d. each, and Messrs. George Schultz & Co., for the pony-wheel tires at 10s. 8½d. each. John Batt & Co. will sublet to Vereinigte Stahlwerke van der Zypen und Wissener Eisenhütten A.G., Cologne, and Gutehoffnungshütte Aktienverein für Bergbau und Hüttenbetrieb, Oberhausen, Germany; and George Schultz & Co. will sublet to Vereinigte Stahlwerke van der Zypen und Wissener Eisenhütten A.G., Cologne, Germany. The four lowest tenders in each case were for German material; the fifth and lowest English tenders were, for driving-wheel tires, Cammell, Laird & Co., 22s. each, and for pony-wheel tires, Steel, Peech & Tozer, Ltd., 19s. 2d. each.

Luton.—The T.C. has accepted the tender of the Hudson Economiser (1907) Co., Ltd., 110, Bishopsgate, London, E.C., for a cooling tower of 125,000 gallons capacity per hour, at £637 10s.; and that of Messrs. Hayward, Tyler & Co., Ltd., for a motor-driven feed pump (8,000 gallons) at £120.

Peterborough.—The Borough Education Committee has accepted the tender of Messrs. G. Andrews & Co., for electric light fittings for the new Lincoln Road Schools.

Salford.—The tender of Messrs. Babcock & Wilcox, Ltd., has been accepted, at £2,025, by the T.C. for the supply and erection at the electricity works of a water-tube boiler, superheater and mechanical stokers.

Southampton.—The T.C. has received the following tenders:—

Surface Condenser.

Willans & Robinson, Ltd.	(accepted)	£730
The Mirrlees Watson Co., Ltd.		750
John Musgrave & Sons		775
Cole, Marchent & Morley, Ltd.		806
Richardsons, Westgarth & Co., Ltd.		860

One 200-kw. Two-Phase Synchronous Motor.

The Electric Construction Co., Ltd.	(accepted)	£655
The British Westinghouse Co., Ltd.		670
The British Thomson-Houston Co., Ltd.		714
Mawdsley's, Ltd.		760
The Lancashire Dynamo and Motor Co., Ltd.		847
Dick, Kerr & Co., Ltd.		988

Swindon.—The T.C. has accepted the following tenders:—

Tudor Accumulator Co., Ltd.—Battery, £1,482, and £119 per annum for maintenance. (Tenders ranged from £1,210 to £1,741, and from £84 to £130 respectively.)

Chloride Electrical Storage Co., Ltd.—Automatic reversible traction booster and switchgear, £1,029. (Tenders ranged from £964 to £1,109.)

Electric Construction Co., Ltd.—Three-wire hand-regulated booster, £275. (Tenders ranged from £275 to £423.)

Messrs. H. & C. Spackman, Swindon.—Battery station, &c., £403.

Rotherham.—The Education Committee has accepted the tender of Messrs. Smith Bros., Ltd., of Rotherham, for E.L. fittings for the South Grove School, at £23, and 1s. 9d. each for extra pendants.

Wednesbury.—The Corporation Electricity Committee has accepted the tenders of the Tudor Accumulator Co., Ltd., Messrs. Johnson & Phillips, Ltd., and Mr. H. J. Smith, for further extensions at the electricity works, at a cost of £2,902, this being an increase of £352 on the original estimate.

York.—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for high-tension cable for the extension to Messrs. Rowntree's works, at £2,640.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Col. H. M. Leaf.

The following Orders are issued for next week:—

Headquarters will be closed for instruction, but will be open for office work as under until further orders:—

Monday, 7th Tuesday, 8th Wednesday, 9th Thursday, 10th Friday, 11th	10 a.m. to 4 p.m.
Saturday, 12th	10 a.m. to 12 noon.

(Signed) P. H. Campbell, Capt. R.E., Adjutant for O.C. London Electrical Engineers.

NOTES.

A Tough Pope Lamp.—A municipal employé reports that he was recently sent to a private house to repair a pendant that had fallen, owing to the breaking of the flex; he found the lamp, lampholder, and shade lying on the floor, the shade broken to fragments. After rewiring the lampholder and putting on a new shade, he picked up the lamp, expecting to find it broken, but on putting it into the holder it lit up as well as ever. The lamp (which was a "Pope" with metallic filament) had not been injured in any way by a 7-ft. fall, a circumstance which speaks well for the quality of the lamp.

Mechanical Engineers or Artisans?—The following paragraph from the *Standard*, of July 28th, is too delicious to be overlooked:—"Two hundred British engineers and mechanics who have been attending lectures at Zurich left yesterday on a tour through Switzerland for the purpose of visiting the principal electro-technical establishments and also various engine works."

Oil Engine Fuel.—The contradictory reports once so rife in regard to suction producer plants appear to have ceased. Possibly this is because of those producers having been brought by experience into better shape. The oil engine is now passing through the same period of doubt and inquiry which was the lot of the gas producer. Sometimes it would appear that the makers of the oil engine do not themselves fully realise its limitations or its possibilities. Would-be purchasers who see oil engines at work can be assured that they will be perfectly satisfactory so long as they are supplied with a refined oil of the cheap lamp-oil variety.

For a long time the use of crude or heavy oils was not seriously attempted. Some oil engines to-day will, it is claimed, work as readily with crude oil as with refined, though they will not give the same power with the cheaper oil. Some makers claim that their oil engines will deal with oils having a heavy tar base, and will run long periods without showing any deposit in the cylinders. Others again declare concisely that no oil engine can satisfactorily use an oil with an asphaltic base, but that there will be very serious deposit within the cylinder, and that an engine run with such an oil will be found when cold with its piston glued fast in the cylinder. Such as hold this opinion uphold, therefore, the system of vaporising the oil in a vessel separate from the cylinder, heating this vaporiser only to such a temperature that the oil will not be "cracked" or partially decomposed, but will be strictly distilled fractionally, the temperature being sufficient only to evaporate the constituents of the oil which can safely be admitted to the cylinder, whilst the non-vaporised residue is allowed to gravitate out of the vaporising chamber. In such engines the oil vapour is swept into the cylinder with air on the suction stroke and burned like gas, the residue to the amount of about 20 per cent. becoming even solid when cold.

Oil with an asphaltic base is particularly condemned by some engineers; others do not seem to desire to reject such oils, but rather to gloze over inquiries with fair words. Others say distinctly that their engine will use any oil, for it will reject the bad portions, which are thus not even admitted into the cylinder.

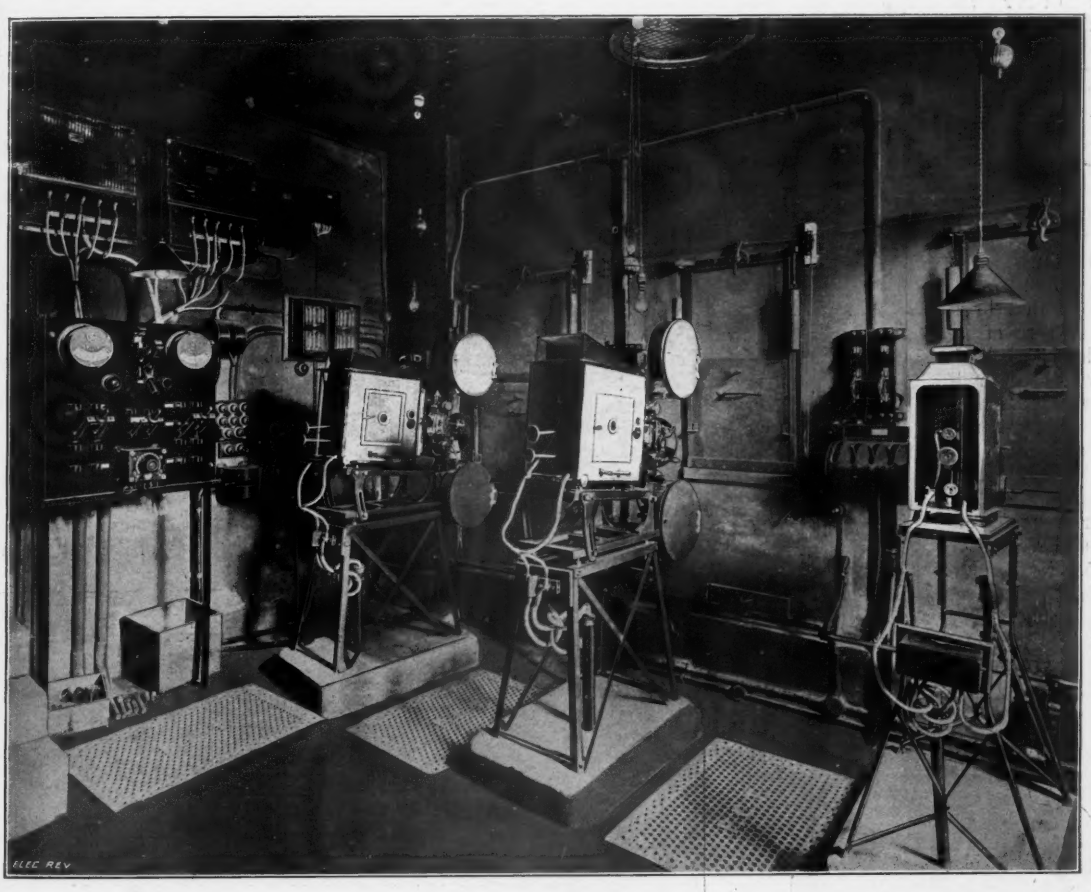
Given an assured supply of really cheap oil, the oil engine would very frequently put the producer gas engine out of court. The one engine will run with less stand-by attention than the other, drawing its own fuel from store if necessary; the other will run at most so long as a deep gas producer will permit, and it is never certain that a producer will not hang up, so that attention cannot be long absent.

(*Continued on page* 183.)

THE PICTURE HOUSE, BRIGGATE, LEEDS.

A prominent feature of the last 18 months has been the rapid rise in public favour of the electric theatre or picture palace. Every town in the British Isles now has its cinematograph entertainment, and in the majority of cases the supply of electrical energy is taken from the street mains. Although in some cases two performances are given each evening, the majority favour the continuous programme, and undoubtedly the latter is preferred by the central-station engineer, who is constantly endeavouring to improve his load factor.

The theatres vary greatly in size and style of decoration, but the old style of show, in which an empty shop in a back street, a few forms, one cinematograph machine, a questionably clean sheet, and a muscular attendant sufficed, is rapidly giving place to the large, luxuriously furnished, and perfectly ventilated "picture house," which one may enter at any time between 11 a.m. and 11 p.m., and where, for the modest sum of 1s., one may be sure of passing a pleasant hour, watching the reproduction of current events, or partaking of light refreshments in the lounges at will.



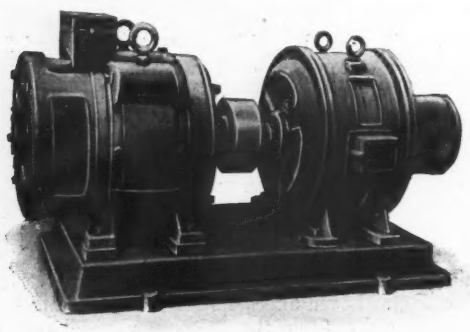
The Picture House, Leeds: Interior of Lantern Room, showing Switchboard, Dimmer Levers, &c.

In view of the importance of this feature of modern town life, we give below a description of one of the newest establishments of Provincial Cinematograph Theatres, Ltd., namely, The Picture House, Briggate, Leeds. This theatre, we understand, forms one of a large circuit, 12 being already open at Belfast, Bristol, Birmingham, Dublin, Edinburgh, Glasgow, Leeds, Leicester and Manchester, respectively, while others are in course of construction at Liverpool, Nottingham, Newcastle and Portsmouth.

The building, which is of fireproof construction throughout, includes vestibule, foyer, lounge and theatre on the ground floor, balcony and Wedgewood tea lounge on the first, and an oak panelled smoking room on the second floor. The lighting is, of course, by electricity in accordance with "Home Office Regulations, 1910," and so far as possible the inverted and concealed system has been adopted. Where the head room is limited, opal bowls mounted in inverted fittings, so arranged that part of the light is transmitted and part reflected, have been used, but where the height permits, hammered brass bowls are suspended about 4 ft. below the ceiling, with excellent effect. In the theatre proper, the height of the roof had to be curtailed, owing to the existence of ancient lights, and therefore reflecting bowls, cornice, and even direct lighting were unsuitable, as the line of sight from the balcony would have been obstructed. Arrangements were therefore made to utilise the space between the barrel vaulted ceiling and the roof proper, for combined lighting boxes and extract air ducts (in connection with the ventilating system mentioned later). The ceiling was designed with 12 cathedral glass lights, artistically enriched with fibrous plaster, and the result in the body of the hall, a 600-watt "Osram" lamp being placed above each light, is most effective.

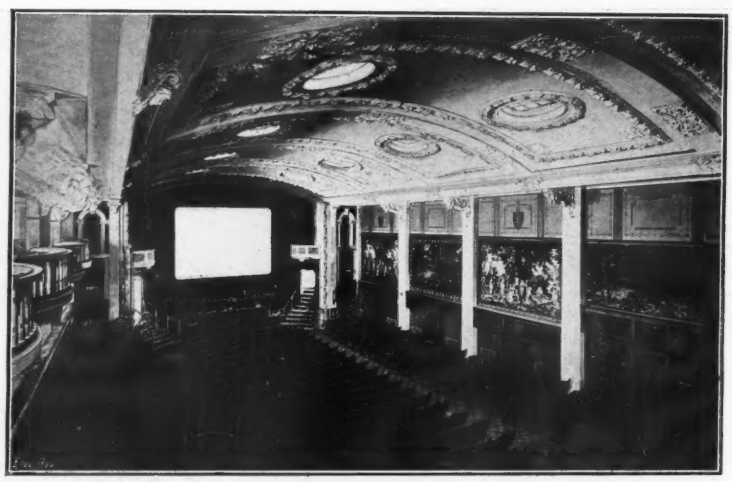
As the programme is continuous, only 90-second intervals being allowed between each film, it is essential that there should always be sufficient light, even when the picture is on the screen, for the audience to find and leave their seats without inconvenience. Red-shaded lamps have been found most suitable for this purpose, and therefore two-light (17-watt lamp) candle brackets fitted with conical red silk candle shades have been fixed round the walls, and red lamps are also placed above the ceiling lights as noted above. Local lighting in the gangways and on the balcony steps is carried out by a very neat reflector, attached to the cast-

iron chair standard in such a manner that the light from the 2½-candle-power lamp is all thrown downwards on to the carpet, and only the reflected light from this reaches the eye.



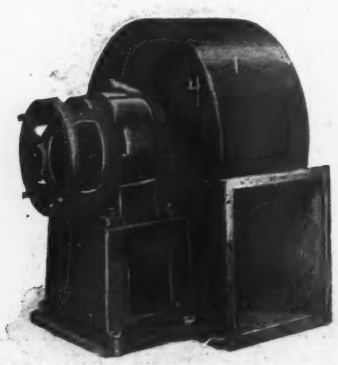
J.-L.-Churton 10-kw. Motor-Generator.

In order to obviate the frequent and instantaneous change from light to dark and *vice versa*, each time the lamps are switched on or off, dimmers are connected in the bus-bar circuit of both red and white lighting sub-distributing boards, so arranged that by a quarter turn of a handle, the whole of the white and red lamps are dimmed and brightened respectively, with a time limit of about 5 seconds.



Interior of Theatre, showing Ceiling Lights and Extract Vents combined, and Inlet Ducts above Radiators.

For the projector arcs a D.C. supply at 65 volts is, of course, required, and this is obtained from a Johnson-Lundell-Churton 10-kw. motor-generator set, the output being 100 amperes at 65 volts, with a guaranteed full-load overall efficiency of 70 per cent. The generator,



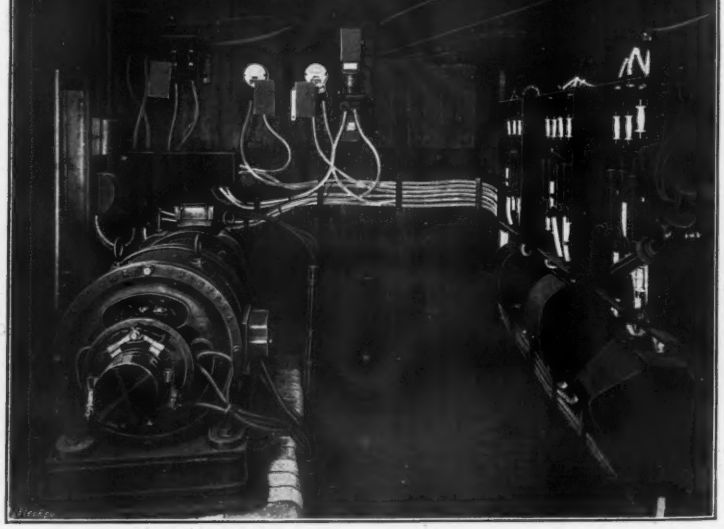
Davidson Exhaust Fan coupled to J.-L. 4-h.p. Motor.

which is compound wound, has the series winding reversed in order to limit the current on short-circuit to 100 amperes.

As a stand-by to the generator set, a Morris & Lister auto-transformer, having an output of 130 amperes at 65 volts, has been installed, but this will only be used in cases of absolute emergency, the light emitted from an A.C. arc being, of course, very unsteady.

The ventilation of the building (which is open to the public 10 to 12 hours per day, smoking being permitted) forms a very important feature, and in practice it has been found necessary, in order to keep the atmosphere sufficiently clear for the perfect projection of pictures, to give 10-12 complete changes of the air per hour. For this purpose a 40-in. Keith centrifugal fan capable of delivering 20,000-25,000 cb. ft. per minute against 1 in. water gauge, and coupled by belt to a 6-B.H.P. Churton motor, is installed in the basement. The air is drawn in through a hair-cloth filter screen, maintained in a moist condition, and is then cooled by means of ice, or heated by passing through a battery of gilled pipes, capable of raising the full quantity of air from 32° F. to 60° F., 600,000 B.TH.U. per hour being required for this duty alone. In order to reduce cooling costs (10-15 cwt. of ice used per day in hot weather), a CO_2 refrigerating plant, capable of reducing the temperature of the full quantity of air 5° F., is shortly to be installed. This will, of course, ensure that the treated air is perfectly dry, as, in passing over the refrigerators, it will be cooled below the dew point and will, therefore, deposit its moisture before entering the theatre.

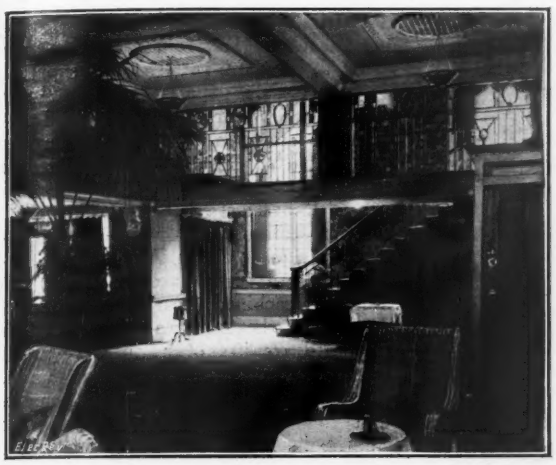
The vitiated air is extracted through the ceiling lights, which are specially arranged for this purpose, by means of a 60-in. motor-driven Blackman propeller fan capable of dealing with 20,000 cb. ft. per minute, against ⅛ in. water gauge. By this system (which was designed and carried out by the company's own staff) draughts in doorways and passages, which are so common in most of the big ventilating schemes, are entirely avoided. The supply of electricity required for the lighting and power installation is taken from the mains of the Leeds Corporation, on the single-phase



Meter Room at the Picture House, showing Main Distributing Board and Motor-Generator.

system at 200 volts, 50 cycles, by means of two 0·3 c.c. services, laid in earthenware ducts from Trinity Street, directly under the concrete floor of the theatre, to a special meter room beneath the lounge.

In order to secure continuity of supply, the load is equally divided between the two services, one main lighting and one main power distribution board being connected to



Lounge, showing Reflected Lighting by Metal Bowls.

each. These boards are each fitted with two linked S.P. switches and two S.P. bridge fuses per way, and are themselves individually controlled by 100-ampere D.P. switches and S.P. fuses of the ironclad type.

The two main lighting boards feed the local distribution boards (carrying approximately 25 amperes each) fixed in various parts of the building convenient to the load, but each of the motors and the stand-by transformer are fed direct from the main boards, one way being allotted to each.

For the candle lamps, seat lights, signs and orchestra lights, six 50-volt distribution boards are provided, and these are fed from one way of the nearest 200-volt sub-distribution boards, through Morris & Lister 4 to 1 ratio auto-transformers, controlled by 5-ampere D.P. switches.

The D.C. supply from the generator is taken direct to one side of a D.P. throw-over switch on the lantern room switchboard, the other side being connected to the stand-by transformer, in order that the change over from D.C. to A.C. supply can be made without loss of time. In addition to the D.P.throw-over switch controlling the two cinematograph lantern circuits, a Morris & Lister auto-circuit-breaker of the thermal type is fitted to the board, and this is found to work well in practice, the heating time lag being sufficiently long to allow the arc to be struck without the breaker opening.

There are two cinematograph machines and one lantern slide projector, the former requiring 80-100 amperes (18 mm. solid and 25 mm. cored carbons), and the latter 20-25 amperes (12 mm. solid and 15 mm. cored carbons) through the arc when running on direct current, with an

Wedgewood Lounge, showing Reflected Lighting from Candles and Glass Bowls.

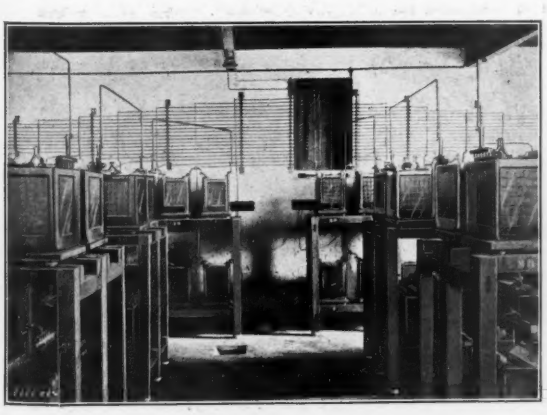
increase of 25 per cent. on these figures when using alternating current.

The whole of the electrical installation has been carried out in Griffiths's solid-drawn screwed conduits by Messrs. W. J. Furse & Co., of Nottingham, to the designs and specification of the company's engineer, Mr. Ronald Grierson.

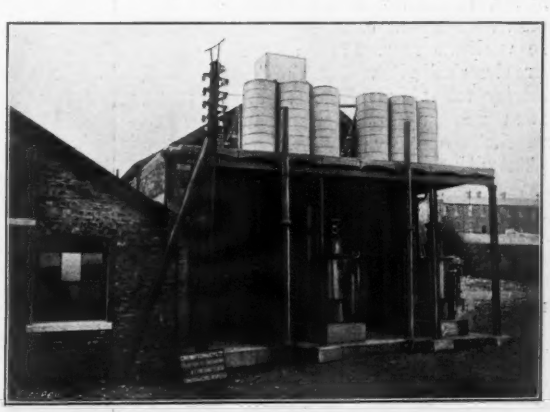
ELECTRICITY SUPPLY IN CARMARTHEN.

A provisional order for electric lighting at Carmarthen was first taken out by Messrs. J. B. Saunders & Co. in 1908; subsequently an agreement was entered into between the Borough Council and Messrs. Saunders for the lighting of the street lamps by electricity, this agreement covering 232 lamps, for which the Council was to pay £680 per annum for a term of 14 years. Under this agreement the Borough Council gave its consent to the use of overhead mains throughout the borough.

Ultimately, as the result of negotiation, Messrs. Crompton

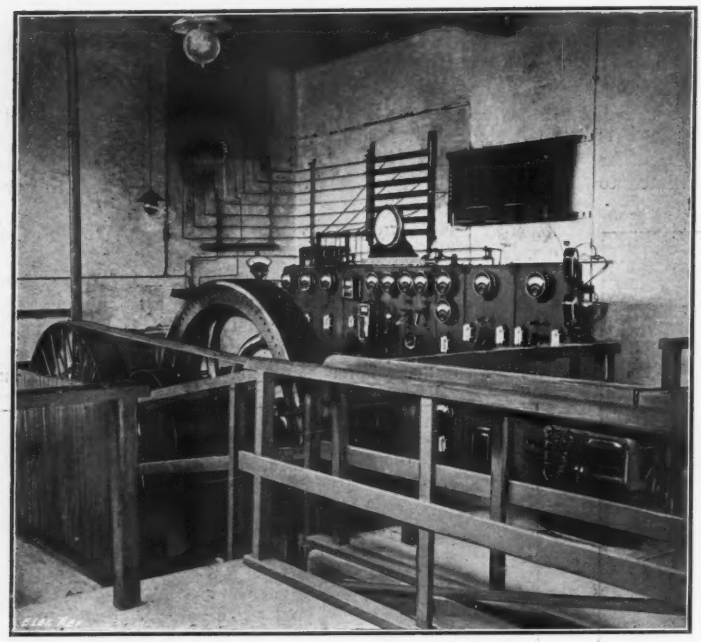


Battery Room.



Producer Plant.

Carmarthen Electricity Works.



Interior of Engine Room showing Main Switchboard.

the engines could be started up electrically; connections were made and switchgear provided, so that the armatures of the dynamos, which are separately excited, can be put across the armatures of the boosters, the booster sets then being started up in the ordinary way. This arrangement has been found to be very reliable, and, moreover, does not cause an excessive demand on the battery when the engines are started, and when the battery is in a low state of charge.

A 3-machine booster set of Crompton and Co.'s standard pattern was supplied. This set consists of a motor capable of driving two boosters at full load, and two boosters each to give an output of 60 amperes at 0—115 volts. The motor is designed to take current at 440—480 volts.

A C.M.B. automatic balancer is installed, capable of dealing with 45 amperes out-of-balance voltage on either side of the three-wire system, varying between 210 and 235 volts. This machine takes up very little room, and is found to be exceedingly efficient. The switchboard consists of plain slate panels carried on a wrought-iron framework, and is equipped with all the necessary instruments and switchgear for controlling a modern three-wire installation. Besides controlling

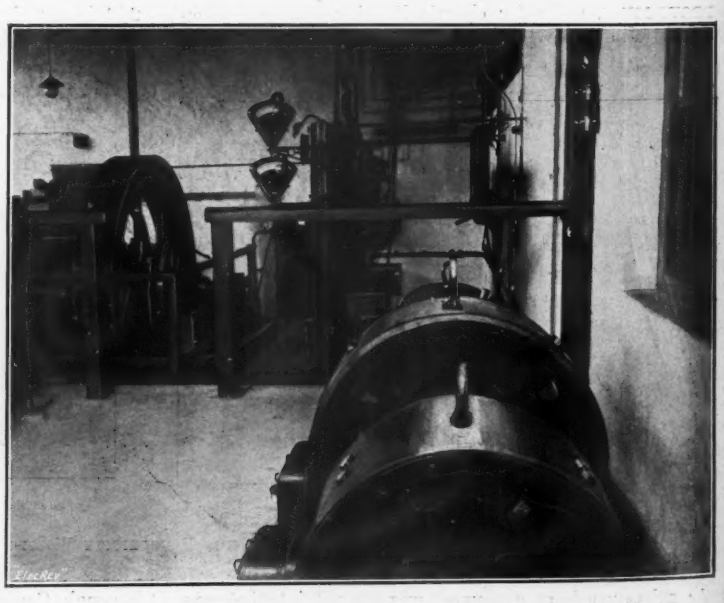
Typical Street Views, Carmarthen, showing the Overhead Wires and Street Lamps.

and Co. became interested in the scheme, and after investigating the possibility of the area, floated a local company, with Dr. J. A. Purves, of Exeter, as consulting engineer. Messrs. Crompton commenced to carry out the work in May, 1910, and the streets were electrically lighted on the August Bank Holiday following from a temporary plant, which was superseded by the permanent installation on November 1st.

This plant was designed to deal with connections equivalent to about 5,000 8-c.p. lamps, and consists of two single-cylinder horizontal type Crossley gas engines, each capable of giving 50-b.h.p. continuously, and working from gas producers using anthracite coal.

These engines drive, by means of belts, two Crompton multipolar open-type shunt-wound dynamos, each capable of giving 35 kw. at 440/480 volts. Each machine is fitted with a special pulley fly-wheel; this, combined with the fact that the engines are of Messrs. Crossley's electric lighting type, renders the supply exceedingly steady.

It may here be mentioned that arrangements were made on the switchboard, so that



The Engine Room, Carmarthen Electricity Works.

the plant above described, the board controls a battery and three feeders.

Battery regulating switches are provided, but these are mounted away from the board on the battery room wall, so as to keep the connections between the regulating cells and the regulating switch as short as possible.

All the usual recording instruments are fitted, the two recording voltmeters being installed in the engineer's office, with change-over switches, so that they can be used to register the voltage of the 100 cells during the last hour or so of charge.

The battery consists of 250 D.P. cells, having a capacity of 360 ampere-hours (10-hour rate.) The glass boxes were supplied sufficiently large to enable additional plates to be added and the capacity is now being brought up to 540 ampere-hours at the 10-hour rate.

The station lighting is carried out in steel tubing, with metallic-filament lamps throughout.

The mains are, of course, all overhead, with a pressure of 220 volts between the middle and outer wires of the three-wire network.

Hard-drawn bare copper wire is used throughout, except in a few narrow streets, where insulated wire is used.

There are three feeding points controlled by switch-fuses mounted in water-tight cast-iron boxes attached to the poles which carry the overhead wires. The majority of the poles are of creosoted wood, but in the main streets steel poles are used.

Lightning arresters are provided at the station, with the necessary earth plate.

The street lighting is carried out by means of metallic-filament lamps of 50 and 100 c.p. Plain swan neck brackets with shades and well glasses are fixed to the poles, and the lamps are grouped as far as possible, each group being controlled by a double-pole switch fuse.

In connection with this town, it is interesting to note that it is one of the largest, if not the largest, town in Great Britain to be equipped throughout with overhead mains, the Board of Trade having sanctioned this system after inquiry.

Another interesting point in connection with this town is that it was the first town under the Act (which came into force in April, 1910) in which an inquiry was held as to the position of the generating station. There was a good deal of opposition from the residents to the site, chiefly through ignorance, but the Board of Trade finally sanctioned the site, and it has proved a very suitable one in every way.

Mr. T. D'Nassau was appointed engineer, and his efforts in obtaining a load have proved very successful. There are no less than 130 consumers already connected to the mains, the total connections being equivalent to 82·3 kw. There is likely to be a good demand for the supply of electricity for power purposes, as there are several small industries in the town which it is hoped will install electric motors.

NOTES.

(*Continued from page* 178.)

Machine Tool and Engineering Association, Ltd.—The above Association, which was formed as the result of a meeting of machine tool makers and factors exhibiting at Olympia in 1910, is now in active operation and has a considerable and growing membership. The primary object of the Association was to exercise control over the organisation and frequency of exhibitions, which it was felt, were being overdone. One show will be held in 1912 in place of the two originally proposed; it will be under the direct control of a Committee of the Association, and run from the offices of the latter. Over £5,000 worth of space has been applied for and allotted to members of the Association, exclusive of space applied for by non-members. A strong board of directors has been appointed, with Mr. J. T. Peddie, of Vickers, Ltd., as chairman, and the offices have been transferred to 104, High Holborn, W.C. The policy of the Association with regard to exhibitions is to promote one in London every three years, and possibly one in the provinces alternately with those in London. It is probable that in the matter of exhibitions abroad, the Association will be asked by the Board of Trade to take a very important and responsible position in connection with the engineering section of such exhibitions. Now that the preliminary work has been completed, it is intended to initiate a progressive policy which will be of advantage to the trade generally. Information will be supplied to members from time to time dealing with trade openings abroad, and reports as to proposed legislation affecting the trade and other appropriate matters. It has been resolved by the directors that at all exhibitions organised by the Association, preference in the allotment of space shall be given to members. Each member is expected to take up 20 founders' shares of 5s. each.

Royal Agricultural Show, Norwich.—Referring to our report of the show above-mentioned, Messrs. Mann, Egerton and Co., Ltd., of Norwich, write to point out that our brief allusion to their stand gives quite a wrong impression of the nature of their exhibits. For the application of electricity to agricultural purposes they put down a 10-b.h.p. horizontal type oil engine, driving by belt a 6½-kw. dynamo; the current from the latter was carried to one of their standard switchboards and employed to drive a motor coupled to a standard pump for country house or estate water supply, and to another motor driving a corn grinding mill. In addition they had a high-speed two-cylinder oil engine direct coupled to a standard dynamo supplying current to eight flame arc lamps at the top of the stand; a 3-b.h.p. horizontal oil engine driving by belt a dynamo, illustrating the type of plant used for small country house installations, the current from the dynamo being used for various lamps, fans and heating appliances; also a high-speed oil engine, fitted with pulley, developing 3½ h.p., and used for estate work, such as pumping, grinding, &c. A brochure which they publish shows that they have carried out numerous installations in large country houses; the brochure is particularly well planned and well composed, points of considerable importance in dealing with customers of this class.

Railway Lighting.—Our contemporary, the *Railway Gazette*, in a recent issue, published an interesting article on railway lighting by a railway lighting officer, who, however, showed an unmistakable partiality for gas, and, in our opinion, spoiled an otherwise instructive article by introducing comparisons with electric lighting on an entirely superficial and misleading basis. Mr. Roger Smith, of the Great Western Railway, has since taken the matter up with a view to demonstrating that "candle-power-hours" is no real criterion of actual illumination. The following, which is a portion of one of Mr. Smith's letters in the above controversy, may interest electrical men:—

"A certain platform divided into two, longitudinally, by a brick wall, is lit on one side by electric tungsten lamps and on the other by inverted gas mantles, both installations being of the latest modern description. Each sort of lamp is equally spaced, and is an equal height above the platform, both being arranged to give as nearly as possible exactly the same minimum illumination midway between lamps. The minimum illumination as determined by a great number of measurements on a Trotter photometer is 0·022 for gas and 0·0235 for electricity. The candle-power of the gas lamp is 50 and of the electric glow lamp 40. During the time that the test lasted the candle-power-hours of the gas lighting were 90,000 and of the electric lighting 72,000. Both gave practically the same minimum illumination, but the maximum for electric light was 29 times the minimum, and the maximum for gas was 84 times the minimum. If costs had been taken out on the basis of candle-power-hours the gas gives better lighting than the electric light. The illumination photometer shows that while the minima are the same the contrast between maximum and minimum for gas is too great, the reason being that in that particular instance the shape of the mantle was such that far too much light was produced vertically downwards and not enough horizontally. . . . The short gas mantle does not give sufficient light in the horizontal direction and gives too much light in a vertical direction, so that the contrast between maxima and minima is much too great for good lighting. For platform lighting much better distribution can easily be obtained with the upright mantle than with the inverted mantle in small sizes, but as the candle-power increases and the inverted mantle grows longer, this defect is remedied. . . . As far as comparison between lighting by gas and lighting by electricity goes, the amount of illumination for a given sum of money depends partly on the cost of gas or of electricity, but where these are equal for the production of a maximum amount of candle-power in the same direction, their real value for most classes of railway lighting can only be judged by the shape of the distribution curve of candle-power in all directions in a vertical plane."

Power-Limiting Reactances.—At the Chicago Convention of the American Institute of Electrical Engineers last month, a paper was read by Messrs. R. F. Schuchardt and E. O. Schweitzer, on the use of reactances to limit the short-circuit current of large generators. Short-circuit tests were made on a 12,000-kw. 9,000-volt 25-cycle turbo-generator in the Fifth Street station of the Commonwealth Edison Co. of Chicago, without external reactance and with external reactances of 4 and 6 per cent., and the behaviour of the generator and other apparatus was observed. The instantaneous short-circuit current was not so high as had been expected, but, owing to its comparatively high-power factor, the current produced severe stresses on the generator and the oil switches. It was found that in the case of the generator tested, the use of an external reactance of about 6 per cent. was desirable, limiting the current to a value which could be safely interrupted by properly-designed oil switches, and keeping the torque on the generator at so low a value that even when feeding into the short-circuit on the bus-bars there was no appreciable lessening in the speed, nor was the unit subjected to severe strains. The authors claimed that the use of such coils was apparently the solution to one of the most serious problems in the operation of alternators of high voltage and large outputs.

Mr. E. B. Merriam gave an account of experiments carried on in connection with those described in the preceding paper.

During the tests it was noticed that the field current of the alternator increased when the armature was short-circuited, values as high as ten times normal field current being observed. This phenomenon was attributed to the interaction between the field and armature coils. The records obtained indicated that the voltage thus produced in the field coils under some conditions became as high as seven times normal. When a short-circuit was placed upon only one phase it was noticed that the voltage of the phase not short-circuited rose to a very high value, in some instances as high as two and one-half times normal. The current-limiting reactances consisted of 76 turns of 1-in. diameter copper cable wound on a cement core and supported by a wooden framework. The reactance consumed 6 per cent. of the generator voltage when carrying normal full-load current. With the introduction of this amount of reactance in each phase the maximum instantaneous short-circuit current was reduced to about one-half and the torque on the turbine shaft to about one-seventh of what it would have been without the reactance. When a short-circuit was thrown on the system beyond the reactance the terminal voltage of the alternator was maintained, and the alternator recovered its normal voltage after the short-circuit had been removed much more rapidly than would have been the case had the short-circuit been placed directly across its terminals. The oil circuit-breakers proved capable of opening all of the loads or short-circuits without producing any external disturbance or developing any undue pressures. —*Electrical World.*

Coal Prospects.—A recent Board of Trade White Book gives the following figures of mean cost of coal in the chief industrial countries :—

United Kingdom	8 to 9 shillings
Germany	9 „ 10 „
France	12 „ 13 „
Belgium	12 „ 14 „
United States ... ... about	6 „

These are prices at the pit-head. Thus, there is not far to seek for a prime cause of the prosperity of the United States, at least in such trades as require large amounts of fuel. The populations of the above countries who make their living out of coal mining are as follows :—

	Persons.	*Per worker.*
United Kingdom	966,300	250 to 290 tons
„ States	690,400	500 to 600 „
Germany	591,000	250 „
France	191,000	200 „
Belgium	145,000	170 „

The production per year per worker is given in the last column. The enormous output of the American may be compared with the 490 tons of Australia and the 425 tons per head in Canada. The minimum is that of Japan, 120 tons only. To what are the enormous differences to be attributed? Partly, no doubt, to the use of machinery. Partly, we may be sure, to the reckless way in which the more easily got seams are exploited. It was thus that so large a proportion of the coal in our British mines was left in the ground in scattered patches that are lost to knowledge, and even if known, could not now be made to pay. But a great cause of the small production per head is explicable by the long distances of the working faces from the shaft. There must come a time in every mine when the capital cost of idle walking time becomes greater than the cost of a new shaft or the provision of some means of rapid transit of the men between shaft and face.

This problem is becoming acute in many mines, and seems to invite electrical solution. It cannot conduce to the efficiency of a miner that he should walk miles below ground every working day on his way to and from work. It is but a few years ago that the best Yorkshire steam coal could be purchased for 5s. per ton, and, at the present rate of consumption, about 300 years will see the total exhaustion of known coal to 4,000 ft. in this country. And the output does not stand still.

The Walk to Brighton.—The Electrical Trades London-to-Brighton Walking Race took place on Saturday, July 29th ; six competitors out of an entry of nine started from Westminster Bridge at 5.1.25 a.m., the non-starters being C. S. Blake, A. J. Burbidge and A. Scott. The officials were :—Starter, Mr. C. E. May ; timekeepers, Mr. W. L. Woolveridge (chief) and Mr. A. Edwards ; judges, Mr. A. Edwards, Mr. C. E. May, and Mr. F. J. Worledge ; road marshals, stewards, &c., Messrs. H. S. Stockton, R. Robinson, Ralph Levy, D. Mickleson, C. P. Druitt, G. Cumine, C. A. Sewell, B. Smith, E. Marshall and H. Blackmore ; hon. secretary, S. C. Haynes. When the walkers set off there was a prospect of a cooler day, but as the morning wore on, and the sun shone forth, it became apparent that good times were out of the question. Mr. James Bateman, of Messrs. Bateman & Co., lent two motor-cars for the use of the officials, who were thus enabled to keep in close touch with the progress of the race, but the competitors soon got so spread out that it became difficult to take the desired intermediate times. At Cooper's Stores, Brixton (3 miles) the order was :—A. R. Edwards, Associated Fire Alarms, Ltd., 27 min. 22⅘ sec. ; Roland Farnhill, Callender's Cable and Construction Co., 29 min. 37⅕ sec. ; S. A. Hardstone, National Telephone Co., 33 min. 41⅖ sec. ; H. Tolley, General Electric Co., Ltd., 33 min. 55 sec. ; H. E. Purnell, General Electric Co., Ltd., 34 min. 11⅘ sec. ; A. J. Meakins, Wakelin Bros., Ltd., 35 min. 50⅖ sec. At Streatham Hill Station (5 miles 316 yards), Edwards passed in 46 min. 25⅘ sec. ; Farnhill second in 50 min. 30⅘ sec. ; Purnell third in 56 min. 24 sec. ; and Tolley fourth in 56 min. 38 sec. Edwards passed the Red Lion, Smitham Bottom (14 miles 68 yards), in 2 hours 14 min. 23⅗ sec., Farnhill being second 23 min. behind At Merstham (18 miles 564 yards), Edwards was 3 miles in front of Farnhill, Purnell being third, Tolley fourth, and Hardstone fifth. Meakins had retired. Chief interest now centred in the competition for the Osram Cup for the first novice to finish.

Tolley retired at Redhill, 21 miles. At Horley, 24 miles 864 yards, Purnell led Farnhill by 15 minutes in 4 hours 57 minutes 55 seconds. Hardstone was now fourth, but after several stoppages retired for good at 36 miles, after passing Farnhill and leading him some distance. The positions were the same right to the finish, the result being : A. R. Edwards, Associated Fire Alarms, Ltd., 9 hours 24 min. 1 sec,, first ; H. E. Purnell, General Electric Co., Ltd., 12 hours 21 min. 53⅗ sec., second ; R. Farnhill, Callender's C. & C. Co., 13 hours 4 min. 56 sec., third. Owing to the funds falling short of the amount required to clear expenses, no scratch prizes were given, and Edwards's only reward will be the honour of finishing first ; Purnell receives the Osram Cup for the first novice, and Farnhill a prize to the value of £3.

A movement is now on foot to organise another race at a shorter distance, and all who are in favour of this should communicate with the Hon. Sec., Mr. S. C. Haynes, as soon as possible.

Joint Committee on Mill Driving.—The *Manchester Daily Guardian* states that a meeting of representatives of the Textile Institute and of the Institution of Electrical Engineers was held at the Textile Institute, Manchester, on Friday last week to consider the question of conducting an investigation into the application of electricity in textile mills, both in the United Kingdom and abroad. It was decided to form a joint committee to be known as the "Textile Mill-driving Committee," to consist of 14 representatives of the Textile Institute and a similar number of representatives of the Institution of Electrical Engineers. Mr. Thomas Roberts, cotton manufacturer, Darwen, was unanimously elected chairman of the committee, and Mr. S. L. Pearce, Manchester city electrical engineer, vice-chairman. The members of the committee were elected as follows :—Textile Institute representatives : Messrs. J. R. Denison (Denison, Preusner & Co.), Bradford ; B. Palin Dobson (Dobson & Barlow), Bolton ; E. P. Fry, Shipley ; Oscar Hall (Robert Hall & Sons), Bury ; Frederick Leeves (Platt Bros. & Co.), Oldham ; Frederick Lye (John Bright & Bros.), Rochdale ; F. Nasmith (Nasmith & Barraclough), Manchester ; W. J. Orr (Orr and Sons), Castleton ; Thomas Roberts (Whipp Bros. & Co.), Darwen ; Fletcher Robinson, Manchester ; George B. Storie, Rochdale ; F. W. Whittaker (Whittaker & Pendlebury), Bradford ; and T. Rowland Wallaston, Manchester. Electrical Engineers' representatives : Messrs. J. F. C. Snell, London ; R. K. Morcom (Belliss and Morcom) ; C. D. Taite (Lancs. Power Co.) ; S. J. Watson, Bury ; H. Wilson, Liverpool ; Prof. Schwartz, Manchester ; S. L. Pearce, Manchester ; J. S. Peck (British Westinghouse Co.) ; H. Dickenson, Leeds ; A. B. Mountain, Huddersfield ; W. B. Woodhouse (Yorks. Power Co.) ; W. N. Rogerson, Halifax ; Dr. Pohl (Phœnix Dynamo Co.) ; and J. Schofield, Shipley. The investigation which the joint committee proposes will be thoroughly exhaustive in its character. It will not be a matter altogether of receiving evidence, but experiments will be carried out with the object of making the final report of real value to everybody concerned in the question of power supply. All the members of the committee are men of practical experience, and the fact that a cotton manufacturer has been appointed chairman indicates that the interests of power-users will have a paramount place in the work of the committee. A report will be published in due course under the direction of the joint committee.

Electricity in Agriculture.—Great developments in the use of the electric current in agricultural operations have taken place in various parts of Switzerland, and noteworthily in the Canton de Vaud. The very smallest communes of this canton are supplied with electricity, which is furnished by a company whose two stations, situated on the banks of the River Orbe, have a capacity of between 12,000 and 15,000 H.P. The primary distributing pressure is 13,500 volts. There are two networks—one with single-phase current for lighting and for small motors up to 1 H.P. and minor motive requirements, the other for power purposes generally, the current being three-phase. More than 40 communes in the canton have founded co-operative threshing societies, each of which possesses a threshing machine driven by an electric motor, housed in a bought or hired building. The shareholders make use of the plant according to a fixed rotation, paying for the same according to either the weight or the number of sacks of grain obtained. The consumption of power is found to be 12 H.P. with an English thresher, and 8 H.P. with a German machine for 650 to 800 kg. production per hour. The simultaneous use of a straw vibrator requires an additional 1 H.P. ; of a straw elevator 1 H.P., and of a straw baling press 3·5 H.P. The current is supplied either by meter or at a rate per year.—*Revue Pratique de l'Electricité.*

Electrical Fatality.—Harold R. Fisher, 23, was killed at the British Thomson-Houston Co.'s works, Rugby, on July 26th. He was employed as an electrical tester, and was working underneath a motor-generator, when by some means the current was switched on at 2,100 volts. He was killed instantly.

Extension of Patent.—Notice is given in the *London Gazette* that November 20th has been appointed for the hearing of the petition of the Automatic Electric Co., of Chicago, for the extension of the term of Letters Patent No. 809, of 1898.

Inquiry.—A correspondent asks for the name of makers of "Velox" switchgear.

Appointments Vacant.—Mains assistant for the Dewsbury Corporation electricity department (37s. 6d.); chief assistant and electrical engineer for the Bournemouth Corporation Tramways (£300); assistant to the wireless telegraph expert in H.M.S. *Vernon*, Portsmouth (£300). See our advertisement pages in this issue.

The Radium Institute.—The Institute will be opened on August 14th, for the treatment of patients, both gratis and on a paying basis.

Bills Advanced.—In the House of Lords on Thursday last week, the Metropolitan Electric Tramways Bill, as amended, was read a third time and passed. On July 20th, the Bristol Tramways Bill was read the third time and passed.

In the House of Commons on July 28th, the Lords' amendments to the Nottinghamshire and Derbyshire Tramways Bill were considered and agreed to, and several provisional order Bills were advanced a stage. On August 1st, the Lords' amendments to the Gloucester Corporation Bill and the Metropolitan Electric Tramways Bill were considered and agreed to, and the Middlesbrough, Stockton-on-Tees, and Thornaby Tramways Bill was read a third time.

Erratum.—In the article on "Miscellaneous Lamp Characteristics," page 156, Table IV, the data for mercury arcs relate only to low-voltage arcs; for quartz lamps the usual C.P. is 800.

Educational Notes.—University College, London.—We have received from the Provost the handbook of the Engineering Faculty for the forthcoming session, which opens on Monday, October 2nd. Prof. J. A. Fleming is the Dean, and Prof. J. D. Cormack the Vice-Dean of the Faculty. Full particulars are given of the degree and diploma courses—applications to enter which must be lodged with the Provost not later than September 20th. Special courses can also be arranged, and post-graduate courses in certain subjects have been organised. In Electrical Engineering Prof. Fleming is aided by Assistant-Professor W. C. Clinton, and Mr. E. Kilburn Scott is Lecturer on Electrical Design. An entrance scholarship, value 120 guineas, will be awarded in September. Application must be made by September 5th to the Secretary. See our advertisement pages to-day.

City and Guilds (Engineering) College, Exhibition Road, S.W.—Particulars of courses in civil and mechanical engineering are given in our advertisement pages to-day.

Annual Outing.—For the second year in succession the employés of Electrical Installations, Ltd., over 40 in number, spent their annual outing on Saturday last at Clacton-on-Sea. Various amusements were indulged in, and after a substantial lunch at The Clarence, the party toured the beautiful surrounding country in brakes. The weather was all that could be desired, and a most enjoyable day was spent.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Engineers.—The Keighley T.C. has increased the salary of Mr. Webber, electrical engineer, from £250 to £300 per annum.

Mr. J. G. Ellis, secretary to the Newport (Mon.) Electricity Department, has resigned.

Mr. Ryecroft, assistant electrical engineer at Swindon, has resigned.

Mr. R. H. Campion, borough electrical engineer at Dewsbury, has been taken seriously ill whilst on his vacation. It is anticipated that he will be incapacitated from duty for six or eight weeks.

The Luton T.C. has decided to increase the salary of Mr. W. H. Cooke, electrical engineer, from £400 to £450 per annum, as from August, and that of Mr. H. A. Kell, chief assistant engineer, from £140 to £165.

The Southampton E.L. Committee recommends the appointment of Mr. H. Bennett (of the Westminster Electric Supply Co.) as head of the business development department, at a salary of £225, rising in a year to £250 per annum.

Mr. R. A. Stoker, chief draughtsman of the Durban Corporation electricity department, has been appointed electrical engineer to the Kroonstad Municipality (S. Africa).

The Dundalk U.D.C. has appointed Mr. Percy A. Spalding as resident engineer to its electricity supply undertaking. Mr. Spalding will act as clerk of works under the consulting engineers during the erection of plant, &c. There were 96 applications for this post.

Tramway Officials.—The Highways Committee of the L.C.C. recommends that the salary of Mr. J. Welling, permanent-way engineer, be increased from £550 to £575 per year; and that the salary of Mr. E. L. Pope, resident electrical engineer (southern section), be increased from £425 to £450 per year.

The Bolton T.C. has been recommended to increase the salary of Mr. C. Day, tramway overhead superintendent, from £143 to a maximum of £150 per annum.

The Bournemouth T.C. has appointed Mr. I. Bulfin, chief assistant and electrical engineer, to succeed Mr. C. W. Hill as general manager of the tramways at a salary of £500 per annum, rising by £50 per annum to a maximum of £700.

General.—Mr. B. M. Drake, of Messrs. Drake and Gorham, was severely injured in a motor-car collision last week, his face being cut by the glass screen. Fortunately his injuries were not of a grave nature.

Mr. G. H. Nelson has resigned his appointment as chief outside manager and constructional engineer to the Brush Electrical Engineering Co., Ltd., Loughborough, to take up an appointment with the British Westinghouse Electric and Manufacturing Co., Ltd., of Trafford Park, Manchester.

We have to congratulate Dr.-Ing. M. Kloss, of Messrs. Siemens Bros. Dynamo Works, Ltd., Stafford, on his being appointed Professor of Electrical Engineering at the Technical University, Berlin, Charlottenburg.

Obituary.—On July 27th, M. Ernest Mercadier died, in his 76th year. M. Mercadier, says the *Times*, entered the French telegraph service in 1859, and held the post of Director of Telegraphs during the siege of Paris, when he likewise organised the military telegraph service. After the war he became Professor of Physics at the Ecole Supérieure de Télégraphie, and in 1881 he was appointed director of studies at the Ecole Polytechnique, where he remained until the end of the year 1903. In addition to writing many technical works, he was the inventor of a number of technical appliances, including the multiple telegraph, and he was an honorary member of the Institution of Electrical Engineers.

CITY NOTES.

B.E.T. Capital Reorganisation.

The directors have issued the following proposals for re-arrangement of capital, as they do not consider that a reduction of capital is in the best interests of the shareholders, for the undermentioned reasons:—

The market quotations are not, in the opinion of the directors, a fair measure of the depreciation of assets, because these quotations are determined largely by the dividends paid, and not only by depreciation or appreciation of capital. Moreover, the quotations are very variable, the fluctuations between the highest and lowest prices of the company's share and debenture capital during the past year representing a difference of nearly £1,000,000.

It would be an unnecessary sacrifice to write down the capital of this company to meet the fall in market values; the profits of electrical undertakings have during latter years suffered serious reduction, but if the present indications of a recovery are fulfilled, the profits of the associated companies will increase, and the investments of this company will correspondingly improve in value.

It would be exceptionally difficult in the case of this company to make a true valuation of the assets as a basis for a reduction of capital, because many of the undertakings in which it is interested are subject to purchase by the local authorities; the tenures are of a very varied character, and the purchase prices to be paid by the local authorities upon eventual purchase are largely dependent upon the conditions obtaining at the dates when the options to purchase arise.

A valuation of the undertakings now might prove very prejudicial to the interests of the shareholders in negotiations and arbitrations which will take place when undertakings are purchased by local authorities.

With regard to depreciation of assets, the directors have already stated in the report for the year 1910, that "they propose for the immediate future to deal with the depreciation as and when its amount is ascertained, and so long as such depreciation continues to transfer to reserve any profits or losses (other than accrued dividends or interest) made by realisation of present investments," and this policy is being adhered to.

The proposals of the directors for a re-arrangement of capital, if adopted, would have the effect of giving the preference shareholders priority as to part of their capital in a distribution of assets as well as priority as to dividend, and of giving the ordinary shareholders a better position in regard to dividend on a part of their capital; or, stated reciprocally, the effect of the proposals would be that the preference shareholders would waive part of their rights as to future distribution of profits in favour of the ordinary shareholders, and the ordinary shareholders would waive part of their capital rights in favour of the preference shareholders. It is proposed that this should be done by converting the existing capital into—(*a*) first preference shares entitled to priority as to capital, and to a 6 per cent. cumulative preference dividend; (*b*) second preference shares entitled to priority as to capital over ordinary shares, and to 6 per cent. per annum (not cumulative), and further entitled, after the preferred ordinary shares have received 6 per cent. per annum out of the profits of each year, to the surplus profits until the arrears of dividend of £266,371 on the existing preference capital are paid off; (*c*) preferred ordinary shares entitled to 6 per cent. per annum after the first and second preference shares have received 6 per cent. per annum; (*d*) deferred

ordinary shares entitled to the remaining profits. The preferred ordinary shares and the deferred ordinary shares will rank *pari passu* as regards capital; and by converting (1) each existing £10 preference share into £2 10s. in cumulative first preference shares, £2 10s. in second preference shares, £5 in preferred ordinary shares; (2) each existing £10 ordinary share into £6 in preferred ordinary shares, £4 in deferred ordinary shares.

The present issued share capital is 161,437 6 per cent. cumulative preference shares of £10 each, and 133,301 ordinary shares of £10 each, or a total of £2,947,380. Both classes of shares rank alike as to capital. The full dividend on the preference shares has been paid up to September 30th, 1908. The first preference shares will rank for dividend as from April 1st, 1911, and on this basis the arrears of dividend on the existing cumulative preference shares at July 31st, 1911, will amount to £266,371. The nominal capital which is now £4,000,000 divided into £2,000,000 preference shares and £2,000,000 ordinary shares, all of £10 each, will be divided into £500,000 first preference shares, £500,000 second preference shares, £2,000,000 preferred ordinary shares, and £1,000,000 deferred ordinary shares, all of £1 each, but no shares will be issued, except as provided, without the approval in general meeting of the holders of the various classes of shares affected. Holders of the first and second preference shares, and of the deferred ordinary shares, will be entitled to one vote in respect of each share of either class, and holders of the preferred ordinary shares will be entitled to one vote in respect of every five shares.

Effect of the Proposals in regard to Capital.—The holders of the existing preference shares will hold all the first and second preference shares, which will have priority of capital over the ordinary shares. This represents priority in respect of £5 per £10 preference share, or £807,185 out of a total share capital of £2,947,380, and equality in regard to the remaining £5 per £10 preference share, which they will hold in preferred ordinary shares, while under the present constitution the preference shares rank equally, as regards the whole of the £10 share, with the ordinary shares in distribution of assets. The holders of the existing ordinary shares will hold £6 per £10 share, or £799,806 in preferred ordinary shares, and £4 per £10 share, or £533,204 in deferred ordinary shares. Both preferred ordinary shares and deferred ordinary shares will rank alike as regards capital, and will be entitled in a distribution of assets to any surplus after the first and second preference shares have received the return of their capital.

Effect of the Proposals in regard to Profits.—The dividend of 6 per cent. per annum on the cumulative first preference shares will amount to £24,215, which was the amount distributed on the existing cumulative preference shares in each of the last two years (viz., 1½ per cent., or 3s. per share on 161,437 shares of £10 each). The preference shareholders will thereupon be entitled to further profits up to a further £24,215 as holders of the second preference shares. The holders of the present preference shares will therefore be entitled, preferentially as holders of the first and second preference shares, to all the first profits up to an amount equal to double the profits distributed in each of the last two years. A dividend of 6 per cent. on the preferred ordinary shares will amount to £96,419, and of this the holders of the present preference shares will be entitled to £48,431, and the holders of the present ordinary shares to £47,988. The holders of the present preference shares will be entitled to all further profits until the arrears of dividend of £266,371 are paid off. Thereafter all surplus profits will go to the holders of the deferred ordinary shares, all of which will be held by the holders of the present ordinary shares. Under the present constitution the holders of the ordinary shares are not entitled to any profits until the existing preference shares have received a cumulative 6 per cent., equal to £96,862 per annum, and until sufficient profits have been made to pay the arrears of dividend for the time being on the existing preference shares.

Extraordinary general meetings are to be held in October to consider these proposals.

National Telephone Co., Ltd.

The forty-eighth ordinary general meeting of the National Telephone Co., Ltd., was held on Thursday last week, at Hamilton House, Victoria Embankment. Mr. George Franklin presided.

The Chairman, in moving the adoption of the report (see Electrical Review, page 104), said that during the past half-year there had been added to the system 15,675 stations, as compared with 16,286 stations in the corresponding period of 1910. When they remembered that they were shortly approaching the termination of their licence, and that there were consequently many cessations, it must be gratifying to them to see that they were still able to attach to their system such a large number of stations, making the grand total remaining on June 30th last, 549,928. The income accrued in respect of the business of the half-year, £1,807,871, showed an increase of £129,559. The Post Office royalties amounted to £173,424, or £11,543 more than in the corresponding six months of 1910, and the total amount which they had paid to the Government under this head was £3,645,820. After deducting the Post Office royalties, the net income stood at £1,634,447, being an increase of £118,016. The working expenses, £1,058,169, were larger by £86,255, and left a net profit of £576,277, as compared with £544,516, an increase of £31,761. That sum had been disposed of by an additional transfer of £25,000 to the reserve, making £200,000 for the half-year, and the remainder had been absorbed in the payment of debenture interest and dividends. The percentage of working expenses to net income was 64·74 per cent., as compared with 64·09 per cent. That appeared to show an increase in working expenses, but it was not really so, because the increase was more than due to a sum of £50,000, which had been charged against the profits of the half-year under the title of inventory and arbitration suspense account. He had been asked why the company continued to expend such a large sum as £211,121 on construction, seeing that they were so near to the end of their licence. The answer was, first, that in a telephone business the capital account never closed, and he thought the shareholders might be reassured that the whole policy of the board was so to direct the capital expenditure as to make it reproductive in income within the period of the licence. But even that would not be sufficient unless it could be shown that when the winding-up came, and the property was transferred to the Postmaster-General, their purchase money would be larger by reason of this expenditure, which they were now making. The view of the board was that no capital should be spent except such as would produce an added sum at the time when the arbitration came on, and their system was over. During the past year the board had deemed it wise to ask for offers of the 3½ per cent. debenture stock up to a sum of £500,000, and in view of the opinion of counsel as to the amount at which such stock might ultimately be repayable, a limit of par value was placed upon it. For this they had in various quarters been subjected to adverse criticism on the ground that in certain events this stock was redeemable at 103. The company had been advised by eminent counsel that the events referred to in the certificate, and the instruments creating the stock, had not and never could arise, and that any payment of the premium mentioned, that was 103, would only result in depriving the holders of the junior securities of moneys which were properly theirs. In March last when the board made the offer, the price of the debenture stock in the market was only 98½, and it was felt that in fixing the limit at par for those who desired to offer stock, a fair and a reasonable attitude was adopted, having regard to the opinion of counsel, which they could not afford to disregard. As to the policy of such repayment, he thought it would be obvious to shareholders that there could be no better investment for the company's spare funds than in paying off their debenture obligations. With regard to their credit balance shown in the balance-sheet, £436,886—as shown in the appropriation account, dividends had absorbed £218,750, and reserve fund account £200,000, leaving £18,136 to be carried forward. The reserve fund totalled £4,059,123. Shareholders were constantly asking him where this £4,000,000 odd was to be found. The answer was that, to the extent of £1,839,800, it was represented by solid cash and by freehold and leasehold properties. As to the balance, he could say with some confidence that it would be found in the assets of the company when these came to be distributed. In other words, the difference had been used by the company in carrying on the business instead of the shareholders being asked to supply more capital for the purpose. He thought that this account had now reached a sum which should be ample to protect the shareholders' capital from any possible diminution in value. The work upon the enumeration and checking of the inventory commenced in October last. It was occupying the constant time and attention of a staff of about 500 persons, and was, of course, a great expense alike to the Postmaster-General and to the company. But the directors believed that no other course was open to them than to face this task, which was, no doubt, a great burden upon the officers engaged upon it. The cost of this work was being charged to the inventory and arbitration account. Last half-year £25,000 was placed to that account, and in the half-year under review £50,000 had been placed to it. Referring to the objections to certain of the company's plant received from the Postmaster-General, and the subsequent legal proceedings, an arrangement had been effected between the Postmaster-General and the company, by which practically the whole of the plant objected to was to be taken over and purchased by the Postmaster-General, certain deductions from the ultimate purchase price of portions of the plant objected to having been agreed to be made by the company. He did not want to say too much about that settlement, but it was one which the directors had cordially approved. There had recently been introduced into the House of Commons a measure entitled the Telephone Transfer Bill, the object of which was to facilitate the arrangements necessary to be made by the Postmaster-General in relation to such transfer. In response to representations made to the Postmaster-General by the company certain alterations had been approved which, while preserving to the Postmaster-General the necessary powers required, would at the same time remove the company's objections to the Bill as first presented. The Bill also made provision for the company's staff, and it was due to the Postmaster-General to express satisfaction at the fair and reasonable provision which he offered to make in this regard.

Mr. S. H. Sands seconded the resolution.

The Chairman, in reply to Mr. Collins, a shareholder, said that the purchase agreement provided in certain events for the transfer either on December 31st next or some day or days to be fixed by the Postmaster-General during 1912. A great deal would depend upon the decisions of the next few months. The all-important question they had to think about was that of price—how best could the company be fairly compensated for the money it had put into this business. That was obviously the question which was still under consideration, and upon its solution depended in a large measure the date of the actual transfer of the business to the Postmaster-General.

The report was adopted.

Kaministiquia Power Co., Ltd.—The directors announce the usual quarterly dividend at the rate of 3 per cent. per annum.

Metropolitan Railway Co.

The half-yearly meeting of the shareholders of the above company was held on Wednesday at the Great Eastern Hotel, Liverpool Street, Lord Aberconway presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 142), said there had been an increase of £1,019 in the maintenance of way, works and stations; an increase of £2,533 in locomotive and generating expenses, due partly to the increased mileage run, and partly to a slight increase in the price of coal; and an increase of £858 in carriage and wagon repairs. There had been a saving of £2,264 in traffic expenses due to economies effected in various directions. Law and Parliamentary expenses were up about £618, in consequence of their having had to oppose several Bills in the present session of Parliament. Rates and taxes showed a decrease of £5,060. The passenger traffic on the Metropolitan line proper, apart from the joint lines in which they were interested, showed an increase of £5,610; parcels showed an increase of £1,264, and merchandise and minerals an increase of £2,135. Their loss on the Hammersmith and City line was about £2,343 less than in the corresponding period, and they were charging £5,000 to the electrical renewal and depreciation fund, as against £10,000 in the corresponding period. It had been stated that they were unduly reducing that fund, but that was not so. He would remind them that £5,000 was the amount they usually placed to this fund each half-year, and which they considered sufficient under normal conditions. Last year they were about to enter into a contract for the renewal of their generating plant at Neasden, and they thought it wise to take advantage of the fact that they had received some moneys which were not strictly applicable to the revenue of that year, to make a special provision for the strengthening of the electrical renewal fund. He might say that this fund now stood at £87,697, and that when they had paid for that portion of the work now proceeding at Neasden which was chargeable to revenue, they would still have £37,000 left to the credit of the fund, which, in view of the fact that they would have an entirely new generating plant, they considered would be amply sufficient. They intended gradually to add to the fund out of revenue. Their proportion of the profits on the working of the Metropolitan and Great Central joint line north of Harrow was more by £2,342, which he considered very satisfactory, especially as regarded its promise for the future. A short time ago they introduced some new compartment stock trains into this service for the purpose of running through to the City. These trains were exceedingly comfortable, and had been so greatly appreciated that they had decided to purchase four more similar trains for the same line to be in readiness for the further improved service which they intended to bring into operation as soon as the alterations at Baker Street were completed. During the half-year there had been a small increase in both the electrical and the steam mileage. It was necessary in these days of quick and frequent train services to keep their line well to the front, and that could only be done by increasing their train services judiciously to meet the public demand. After providing for the debenture and preference stocks, they had a balance of £61,425 available, for the dividend on the ordinary stock, as compared with £41,869 12 months ago. That would admit of their paying a dividend at the rate of 2 per cent. per annum, and carrying forward £4,104. That was an increase of ¾ per cent. in the dividend, and he thought they were justified in regarding the result of the half-year's working as very satisfactory. The percentage of expenditure to gross receipts during the half-year was 48·83, as compared with 49·56 in the corresponding period, and the percentage of expenditure to traffic receipts alone was 53·9, as against 54·9. The number of passengers carried during the half-year was more by 562,420. Their season-ticket traffic showed a very satisfactory increase, which was evidence of the growing popularity of the line and of the appreciation by the public of their increased train services. On the subject of rates and taxes he was glad to be able to report that as the result of the revaluation of the line for the new quinquennium, which commenced last April, and of very lengthy negotiations with the various authorities in London, they had succeeded in effecting a reduction of £26,852 in their rateable value, which meant, on the present poundage, a saving in cash to them of about £10,000 per annum. They had had the advantage of this saving for three months in the accounts under notice, and, in addition, some refunded money which they had received as the result of the new assessment. The importance of these reductions to them was very great, and they justified the view he had always expressed there, that railway property was unfairly treated by local authorities in matters of rating. He wished to say that their contract with the Westinghouse Co. was proceeding quite satisfactorily, and the first of the new machines had been running some little time, and had been of the greatest service to them. They could not afford to suffer the slightest risk of a suspension of the services by any of their generators failing to perform their work.

Col. Probyn seconded the motion, and the report was adopted.

Anglo-American Telegraph Co., Ltd.

The half-yearly meeting of the shareholders of the above company was held on Friday last at Winchester House, Old Broad Street, Mr. F. A. Bevan in the chair.

The Chairman, in moving the adoption of the report (see Electrical Review, page 143), said that the Western Union had come to the conclusion that the pooling agreement of 1882, by which the two companies shared the receipts in certain proportions, was invalid under the Sherman Trust Act, and they gave them notice that, having made that discovery, they would as from March 1st cease to carry out its terms. Since then they had no longer handed over to them the American traffic, the result of which was that they had earned £37,000 less. He wished to emphasise that that showed the immense importance of keeping on the best of terms with the Western Union, as a good deal more than half their traffic arose on the other side of the Atlantic. It was in the power of the Western Union with their enormous ramifications throughout the whole Continent to dispose of that traffic as they pleased. So long as there was a pooling agreement it did not matter which line it came by, but directly the pooling agreement ceased to take effect the Western Union, having, in the meantime, laid a third cable, which enabled them to carry the traffic which hitherto they had been unable to carry, took the larger portion for themselves. For some months before that occurred, they had been negotiating with the Western Union for a new agreement, and he was very hopeful that in a very short time they might be enabled to say that the agreement had been exchanged. The agreement provided that the Western Union were to take a lease of their cables for 99 years, and when he said their cables, that involved the purchase by the Anglo-American Telegraph Co. of the new cable that was laid down by the Western Union Co. That would absorb the greater part of their renewal fund—certainly, at least £700,000, or perhaps a little more. The Western Union were to give them a guarantee of 3¾ per cent. on their ordinary stock, which amounted to £262,500 a year, payable quarterly, and as the preferred stockholders took 6 per cent., that would leave 1½ per cent. on the deferred stock. That was exactly the amount of dividend that they were able to pay their stockholders last year; and on one occasion only had they paid more. The agreement meant that, whatever happened in the future, for 99 years the Western Union, so long as they had a cent in their exchequer—and they had an enormous capital and a large reserve—were bound to keep up this payment of £262,500 a year. They were to maintain the Anglo-American Co.'s renewal fund, just in the same way as they had maintained it—by setting aside £20,000 a year, and the interest upon the securities in which the fund was invested. The management would be in the hands of the Western Union; a small board would be retained who would act really as trustees for the Anglo-American shareholders. The Western Union also were to maintain the cables and all of the property, so that in the very unlikely event of the agreement having to be broken through *force majeure*, their property would be restored to them in the same position, as far as possible, as it was in when it was handed over. When the Western Union first proposed the agreement they stated that they wished to make certain alterations or improvements with regard to the traffic arrangements—they wanted, for instance, to have deferred messages at a cheaper rate, and they (the Anglo-American Co.) saw that very possibly they might suffer loss through those arrangements. Now, of course, the Western Union could make what changes they pleased; they could put on a lower tariff for certain messages, but whatever they did it would be at their own risk—whatever the tariff was, they were bound to pay them this £262,500 a year. Then it must be borne in mind that the larger portion of their business originated in the United States, and not on this side, and therefore, if they were to continue to have their fair proportion of that business, it must be by entering into some sort of arrangement such as that proposed. As to the security, he believed it was as good as they could possibly have, and instead of having a stock which was constantly fluctuating according to the prospects of the traffic, they would have what he might call a gilt-edged security—an absolute fixed rate of interest guaranteed by one of the most powerful companies in the United States.

Sir Gerald Fitzgerald, K.C.M.G., seconded the motion.

Mr. Fry said he believed he was voicing the opinion of all the shareholders when he said that there was a general feeling of satisfaction at the way in which the chairman and the board had carried out these negotiations with the Western Union.

The report was then adopted.

Electric and General Investment Co., Ltd.

The directors report for the year ended May 31st, 1911, a gross profit on the transactions of £11,848. After deducting all general charges and the interim dividend already paid on the preference shares, and providing for the proportion of the final dividend accrued on the preference shares to May 31st, 1911, there remains a balance of £4,176. As a further reserve to meet the depreciation in the company's investments, £2,976 of this amount has been carried to the contingencies fund, raising it to £78,924 as at May 31st, 1911, leaving a balance of £1,200. The directors recommend that the £1,200 be distributed by the payment of a dividend at the rate of 6 per cent. per annum on the capital paid up on the ordinary shares for the year ended May 31st, 1911. The warrants for the dividend on the ordinary shares, as stated above and subject to the deduction of income-tax, were to be posted on July 27th.

In June, 1907, a scheme for the reconstruction of the company, in order to extinguish the founders' shares, was submitted to the shareholders, which had to be adjourned *sine die* owing to its being found impossible at the time to obtain the necessary majority of the holders of the founders' shares to vote in favour thereof. The main objection to that scheme was that it put a new liability for uncalled capital upon the founders' shares. Since then the directors have had the matter before them continuously, and now submit an amended scheme, which they have every reason to hope will meet with the approval of all classes of the company's shareholders. Briefly, the proposals are:—That the existing 100 fully-

paid founders' shares of £5 each be converted into 10,000 fully-paid deferred shares of 1s. each. That the investments deposited many years ago with trustees, on behalf of the holders of the ordinary and founders' shares respectively, be capitalised by the creation and issue of £22,500 5 per cent. redeemable debenture stock and of 30,000 fully-paid deferred shares of 1s. each, making in all 40,000 deferred shares of 1s. each. That there be issued to the holder of each founders' share £125 in 5 per cent. debenture stock, 200 deferred shares of 1s. each fully paid (of which 100 shares will represent the converted founders' share), and a cash distribution of £7; and that there be issued to the holder of each ordinary share 10s. in 5 per cent. debenture stock and one deferred share of 1s. fully paid, and a cash distribution of 6d. The holders of the present founders' shares will receive 20,000 of the deferred shares, and the holders of the ordinary shares will receive the remaining 20,000 deferred shares, thus preserving the existing equities and rights of the two classes of shares. A fuller explanation of the proposed scheme is appended to the report.

Extraordinary general meetings will be held immediately after the close of the business of the ordinary general meeting to carry this scheme into effect, and the directors think it desirable to take the opportunity of bringing the articles of association of the company more into accord with modern practice. Mr. J. B. Braithwaite retires from his office as a director, and offers himself for re-election.

The twenty-second ordinary general meeting of the shareholders of the company was held on Thursday last week at Winchester House, Old Broad Street, Mr. J. B. Braithwaite presiding.

The Chairman, in moving the adoption of the report, said the year had been an uneventful one from the company's point of view. The net result was that they had earned £11,848, as compared with £13,086 in the previous year, or about £1,300 less. That enabled them to pay the dividend on the preference shares, to pay the same dividend as last year—6 per cent.—on the ordinary shares, and to add a further £2,975 to the contingencies fund, which would raise that fund to close on £79,000. Their investments had increased during the year from £244,619 to £250,154. He was pleased to say that the process which was commenced last year in regard to the recovery of their securities was still going on. Last year he told them that there was an improvement of about £7,000 in the depreciation. This year he was glad to say the improvement had amounted to £13,652, so that in the two years there had been an improvement of over £20,000. As he pointed out last year, they had a considerable interest in the British Electric Traction Co., and they would no doubt have noted with satisfaction the improved position of that company as disclosed in the recent report, and also the continued increase in the traffic receipts of the associated companies which had been steadily going on for a considerable period, and which had recently assumed very considerable dimensions. The other companies in which they were interested were the City of London and the County of London Companies, both of which were making excellent progress.

Mr. E. Garcke, in seconding the motion, said he was pleased to be able to confirm the statement of the chairman with regard to the progress which was being made by the British Electric Traction Co. The traffic receipts had undoubtedly been very much better this past year, and the company had in view some new business abroad which might still further improve their profits.

The report was adopted.

The Chairman next proposed a resolution for the rearrangement of the company's capital. He said it would be remembered that one or two attempts had been made to reorganise the capital, but hitherto they had failed to obtain the necessary consent of the holders of the founders' shares. This time, however, they had obtained the support of the holders of those shares, and, he believed, the scheme which the board now recommended was one which was greatly in the interests of the company, and of all classes of shareholders. Briefly, the scheme might be thus summarised. They had at the present time certain securities which were invested under trustees on behalf of the holders of the ordinary and the founders' shares. It had long been felt that it was rather an anomaly to have those securities in a separate basket, while the holders of the ordinary and founders' shares were entitled to their distribution in some form or other. They therefore proposed to distribute those reserve funds, and, at the same time, to simplify the share issues of the company by issuing shares to represent the rights which the founders' and the ordinary shares at present possessed. At the present time the ordinary shares were entitled to a non-cumulative 10 per cent. dividend for each year, and any profits over and above 10 per cent. on the ordinary shares were divided equally between the ordinary and the founders' shares, there being 100 of the latter, of £5 each. They now proposed to convert the founders' shares into deferred shares of 1s. each, giving every founder £5 of capital in the form of 100 deferred shares. They then proposed to create a further 30,000 deferred shares of 1s. each and give 10,000 of them to the founders and the other 20,000 to the ordinary shareholders. Thus, share for share, the effect of this would be that out of the 40,000 deferred shares, the ordinary shareholders would hold half and the founders half, thus exactly preserving their present equities. The deferred shares would be entitled to the whole of the profits after 10 per cent., non-cumulative, had been paid on the ordinary shares. The fund which they proposed to realise would be distributed in the form of 5 per cent. debenture stock. They proposed to give to the holder of every ordinary share 10s. in that stock, 1s. in a deferred share, fully paid, and 6d. in cash. The founders would receive £125 in 5 per cent. debenture stock, £5 in deferred shares, and £7 in cash. The result of that would be that the capital of the company would be very much simplified, as they would only have the 10 per cent. non-cumulative ordinary shares and the deferred shares. As to the preference shares, of course they never had any interest in either of these reserve funds, and obviously they could not have anything out of them. But their position was in no way prejudiced under the rearrangement. The board already had power to issue debenture stock up to £200,000 if they chose. They did not propose to exercise that power except to the extent of the £22,500 contemplated under the scheme, and for that assets of the full value were brought into the company, so that the preference shares would be left exactly where they were now. He was pleased to say that the amount of support which they had received from all classes of shareholders indicated that the general opinion was that the scheme was a just and equitable one.

Mr. E. Garcke seconded the resolution, which was carried unanimously.

Subsequently, extraordinary meetings of the various classes of shareholders were held, when resolutions were adopted for increasing the capital in order to carry the scheme into effect.

Crompton & Co., Ltd.

The annual general meeting of the shareholders of the above company was held on Monday at Salisbury House, London Wall, Mr. John Trotter presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 143), said that all he could say regarding the year's working was that the final result, after paying all charges and providing for the usual depreciation, was a loss of £14,000 instead of £20,000 last year. Prices had remained low, and it required a large turnover to make a satisfactory profit. The condition of the electrical manufacturing industry during the year under review made it far from easy to obtain large sales, but he was glad to say that in this respect there was now a very distinct improvement. In the past they had made large profits out of contracting, but great care had to be exercised in a business of that description; he regretted to say there were two contracts which were the subject of dispute, although they did not anticipate anything but a favourable termination in both cases. The policy of the board at the moment was to do everything to fill the works where so much capital was employed, and while doing this to steer clear of business likely to unduly lock up money. That involved the rejection of a certain amount of contract business, but they would still require an expensive staff in this side of the business, although not so large or so expensive as in the past, and it was under those circumstances that their general manager had tendered his resignation. He (Mr. Trotter) would like to recognise the long and valuable services that the general manager had given them. Referring to the balance-sheet, they would note considerable changes. Sundry creditors and loans from bankers were reduced by £27,000, and cash at bankers showed an increase of over £5,000. Their stock was reduced by £22,000, and trade debtors by over £26,000. There was another item he would like to see reduced, although it remained at practically the same figure as last year, and that was their investments in the Electric Supply Corporation and other companies. The combined value of those investments was too large a one, in spite of the reserve of nearly £21,000 which they held, mainly against the Electric Supply Corporation shares. That company, he was glad to say, was making steady progress, and the chairman had said that a dividend might be expected during the coming year. Nevertheless he was afraid they would still have to exercise some patience before they could advantageously dispose of, at any rate, some part of their holding in that company. The reduction of plant and tools was due to the usual writing down. The final adverse balance was now the large one of £48,000. In the profit and loss account there was a satisfactory reduction of £1,227 in trading expenses, although that item included a considerable sum for renewals of plant and tools and experimental work. Administration expenses showed a small increase of £200. They had hoped that that item would have shown a considerable saving due to economies in salaries, rent, &c., but unfortunately that saving had been more than counterbalanced by special expenses incurred owing to troubles in India and Turkey, and to extra legal expenses. The gross profit was £32,455, against £31,826, and the revenue account showed a final figure of £48,271 against them as a result of the last two years' trading. There was a reduction in fees from £2,007 to £1,440, due to Colonel Crompton having given up his fee as technical adviser. With regard to the coming year, as he had told them, there would be a change in the management. He could only add that during the year the staff had worked zealously, and had done their best to improve the company's manufactures and keep pace with the times.

Colonel J. Clibborn, in seconding the motion, said that since he had been connected with the company, he had devoted himself in the main to looking into its past working, to see under the circumstances what prospects he could find as regarded its future prosperity. One of the first points to determine, he considered, was the efficiency of the works, and he was very glad to be able to tell them that, in his opinion, in the works they had a truly powerful aid to prosperity. He had an opportunity, some time ago, of seeing how the branches in India were working. They appeared now to have got over all the difficulties which were inseparable from branches starting in a new country, and it seemed to him that if their output could be increased they might also look to large profits in the future from that country.

Mr. Gordon remarked that, according to the report, all that

was needed to give them good profits was an increase in the turnover. He communicated with the secretary some months ago, and that gentleman told him that there was not a technical man on the board who knew anything whatever about the industry except Col. Crompton. He (the speaker) quite endorsed that, and he felt sure that, unless something was done in that direction, an increased turnover would make no difference at all. The efficiency of the works had been mentioned. His experience was that their cost charges were so high that they could not possibly compete with a number of other British manufacturers—they had not the ghost of a chance. With regard to their investments in companies, apart from the Electric Supply Corporation, amounting to £34,000 odd, he supposed there was no market valuation for them, but he would like to know, supposing there was a forced realisation, whether they would fetch 10 per cent. of their value.

The Chairman said it was difficult to say what those investments were worth, but they would certainly fetch more than 10 per cent. of their face value. Some of the investments were repayable in full, but they would have to wait some time before they could get the money.

Mr. Gordon asked whether the chairman could enlighten them as to who was to succeed the late general manager.

The Chairman said he could not say anything upon that subject then.

Mr. Gordon said he hoped that in the appointment the company would go outside its staff, and get somebody of reputation in the electrical world who would improve the status which the company held. He was afraid that their name had gone down considerably in India, and he did not think there was much likelihood of their getting a big business there. In Canada their name was unknown.

The Chairman: We don't do business in Canada.

Mr. Gordon remarked that Canada, in his opinion, offered a good field for business.

Mr. Weston said that in default of being able to forecast a decided improvement in the business, he expected that the chairman would have put before them the advisability of winding up the company. The last dividend which the shareholders received was in 1908. The policy of filling the works with work was no good if the work did not pay—the more work they did, the more they lost. They had got a debit balance of nearly £20,000, and supposing they succeeded well enough to make 5 per cent., it would be four years before that debt was wiped out, so that they would at the least have to wait another five years before they could even get a precarious dividend of 5 per cent. Allowing a handsome sum for loss in realisation, he should say that the assets would come out at about £1 per share, and he thought most of the shareholders would rather have that £1 than wait another five years for a precarious 5 per cent. upon their money.

Mr. Andrews said that in view of the very unsatisfactory state of affairs, it seemed to him that it was no use going on unless the directors had very satisfactory grounds for supposing that the future would yield better results than the past. He thought it would be well if the board faced the situation, and considered whether it would not be well to cut down the shares to £1.

The Chairman said he could assure the shareholders that the board were fully alive to the serious difficulties under which they had been and were still working at the present moment. The increase in output would have a very remarkable effect, for in a manufacturing business of this sort they very soon ran into big losses, and, on the other hand, they very soon ran into big profits. He agreed with the speaker who said that they ought to have more technical men on the board. Speaking for himself, he would be only too glad if some skilled electrical engineer could be found to take his position. As regarded writing down the shares, that, he thought, would be a necessity if they could secure a good profit, because they would not be able to declare any dividend unless they did cut down the value of the shares. With regard to winding up, there were other ways of dealing with the concern which were having their attention very carefully, and which would be much more advantageous to the shareholders than endeavouring to realise.

The report was adopted.

The Chairman formally proposed the confirmation of the election of Col. Clibborn to a seat on the board.

Col. Crompton, in seconding the motion, said he held an unusually large proportion of the shares of the company, and he appealed to the shareholders to have patience with the board, who had worked very hard under extraordinarily difficult conditions which he could not explain then for many reasons. The main asset of Crompton's was its works and its staff, and they were in a perfectly healthy condition. It was absolutely untrue to say that they could not manufacture at present prices and realise a large profit on the orders. The crux of the whole difficulty was the present lock up of capital, and if that could be surmounted they could earn sufficient to pay a good dividend.

The motion was carried.

The auditors having been re-elected, the proceedings terminated with a vote of thanks to the chairman for presiding.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share, less income-tax (as last year), for the three months ended July 30th last.

Stock Exchange Notice.—The Committee has been asked to allow the following security to be quoted in the Official List:—Chili Telephone Co., Ltd.—Further issue of 22,000 shares of £5 each, fully-paid.

Mersey Railway Co.

The half-yearly ordinary general meeting of the shareholders of the above company was held on Friday at Worcester House, Wallbrook, Mr. James Falconer, M.P., presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 145), said he was pleased to say that the progress of the company had been steadily maintained. If they compared the condition of affairs now with that which prevailed before the railway was converted to electric traction, it would be seen that the number of ordinary passengers carried had more than doubled, while the number of season ticket-holders had been trebled. The past half-year showed an increase in the net revenue of £4,115 as compared with the corresponding period in 1910. After payment of all expenses there remained a balance of £8,061 available for payment of interest on the contingent debenture stock. They were not, however, in a position to make any distribution at that meeting, as the payment of interest was contingent on the revenue available in each separate year ending December 31st; and therefore increased by the balance from the current half year, the amount would be available for distribution at the next meeting. They would thus be in the happy position of being able, for the first time in the company's history, to pay some interest to debenture-holders who had waited so long and so patiently for a return on their capital.

Mr. Robert Cooper seconded the motion.

Mr. G. Williams said he had to congratulate the directors upon the satisfactory report which they had been able to present to the shareholders. He thought, however, that in the interests of the company, it would be well if the board were to forego their fees for the present.

Mr. W. Dunstall congratulated the directors on having reduced the working expenses from £36,000 in 1908 to £30,000 last half-year.

The Chairman, in reply, said he could not agree that it would be any advantage to the company if the directors gave up their fees. He would remind the shareholders that for many years he and his colleagues took their fees in "D" debenture stock, so that during the troublous and anxious times through which the company had passed they had no fees, and they had practically written them off. The reduction in the expenses was due in a great measure to the work of the engineer and the general manager, and he did not believe they had yet come to the end of economies which would be effected in working.

The report was adopted.

Continental.—France.—The report of the French Westinghouse Co. (Société Anonyme Westinghouse) for 1910, states that in spite of the progressive development of the business and satisfactory results shown by the establishments at Freinville, the year 1910 closed with a debit balance of 131,540 fr., this result being due to the poor financial return made by the electrical department. Orders for electric material have come in well from the railways and the general trade, and compensate for the loss of Italian orders, consequent on the commencement of business by the Societa Italiana Westinghouse. This subsidiary has had a depressed year in consequence of the Italian Government interrupting the execution of its programme of electrification of the State Railways. The Hungarian Westinghouse Co. has commenced to build chassis for motor-cars, and has made a small profit, which it has applied to amortisation. The Leblanc-Westinghouse Co. continued its prosperous career, and distributed a 125 per cent. dividend for 1910, which, however, only enters into the accounts of the parent company for 1911. The Heintz Railway Heating Co. distributed a dividend of 15 per cent. for 1910. The directors propose, in view of the necessity of making certain allowances for depreciation referred to in the preceding year's report and not provided during the past year for want of funds, to reduce the capital from 20,000,000 fr. to 14,000,000 fr.—*Financial Times.*

La Société Electrique Edison, of St. Etienne, reports a profit of £10,859 for the last financial year, as compared with £8,125 in the preceding 12 months.

La Société Havraise d'Energie Electrique, of Havre, has decided to increase its capital from £250,000 to £290,000.

New General Traction Co.—The revenue in the year ended March 31st amounted to £22,656, as against £19,482 in the previous year. A profit of £3,674 is shown, reducing the balance of loss previously shown to £21,631. The Coventry Corporation have given notice of their intention to acquire the Coventry Electric Tramways.—*Financial News.*

National Gas Engine Co., Ltd.—A dividend at the rate of 5½ per cent. per annum (less income-tax) on the preference shares and 20 per cent. per annum (less income-tax) on the ordinary shares for the half-year ended June 30th, 1911, has been declared.

Charing Cross, West End and City Electricity Supply Co., Ltd.—The directors have decided to pay an interim dividend at the rate of 5 per cent. per annum (as last year) on the ordinary shares of the West End undertaking.

Metropolitan Electric Supply Co., Ltd.—An interim dividend for the half-year ended June 30th last at the rate of 4 per cent. per annum has been declared, being the same as last year.

MARKET QUOTATIONS.

Wednesday, August 2nd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£12 10	..
a Copper Sulphate	„	£20	..
a Lead, Nitrate	„	£24	..
a „ White Sugar	„	£22 15	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, n casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5 5	..
a Soda, Caustic (white 70 %) ..	„	£11	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a „ Cyanide (basis 100 %) ..	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£70	..
b „ Wire, in ton lots ..	„	£102	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis	per lb.	6⅞d.	¼d. dec.
c „ Tube (brazed)	„	8¼d.	..
c „ „ (solid drawn) ..	„	7d.	..
c „ Wire, basis	„	6⅞d.	¼d. inc.
c Copper Tubes (brazed)	„	9⅜d.	¼d. inc.
c „ „ (solid drawn ..	„	8⅜d.	¼d. inc.
g „ Bars (best selected) ..	per ton	£71	..
g „ Sheet	„	£71	..
g „ Rod	„	£71	..
e „ (Electrolytic) Bars ..	„	£58 5	15/- dec.
e „ „ Sheets ..	„	£74	15/- dec.
e „ „ Rod	„	£61 10	15/- dec.
e „ „ H.C. Wire	per lb.	7⅜d.	¼d. dec.
f Ebonite Rod	„	5/8	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/11	..
h Gutta-percha, fine	„	8/6	..
h India-rubber, Para fine	„	4/8	4d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	46/9	2½d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£14 5	10/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9	..
d Mica (in original cases) small ..	per lb.	6d. to 2s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large ..	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/0½	..
p „ „ rolled strip & sheet	„	1/1	..
o Platinum	per oz.	172/6	..
e Silicium Bronze Wire	per lb.	8⅝d.	⅛d. inc.
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£193 to £194	£4 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/1	2d. dec.
p White Anti-friction Metals ..	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£30	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, L
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Coronation Fires.—The British Fire Prevention Committee has issued a report on the special fire preventive work undertaken in connection with the Coronation celebrations in the metropolis. About 4,000 occupiers and householders were communicated with by letter, large numbers of inspections were made, 14,000 posters were put up, and 13,000 circulars distributed. Particulars were also issued to the Press, which accorded them considerable space. The result of the precautionary measures was that there was only one fire on the processional route when cleared for the King and Queen, and only 11 other fires attributable to the celebrations during June 22nd and 23rd.—*Morning Post.*

Turbine-Driven Vessel with Electrical Speed Reduction.—An opportunity for comparing the performance of recent improvements in speed-reducing gears with generator-motor systems of connection between steam turbines and propellers will be offered in the construction of two sister-ship colliers now building for the U.S. Navy. The new collier *Neptune* is to be equipped with Milville-MacAlpine reducing gears, while the turbines of the new coal-carrier *Jupiter* will drive generators which in turn supply energy for operating the motors on the propeller shafts.—*Electrical World.*

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have been reassured by the clearer atmosphere which seems to prevail in respect of Morocco. Last week's depression has worn off already to a great extent. Recovery in Consols led to improvement in Home Railway stocks. Financial troubles caused by weak-kneed speculation have been surmounted, and now we come to the holiday season—when, of course, there is nothing much doing, and the inevitable tendency is to let prices sag.

The Home Railway Market is at last feeling the beneficial effects of a batch of good dividends, which, when they were announced, were completely obscured by other considerations. It is pointed out, for instance, that the Brighton Company, thanks largely to its electrification scheme, will probably be able to pay a dividend of 5 per cent. at least upon the Deferred stock, which now stands at 104, and carries six months' dividend. The distribution for the full year will be made next January. Other steam stocks enjoyed improvements, part of which was afterwards lost, and Metropolitans and Metropolitan Districts have moved in sympathy with these, Districts showing ¼ rise on balance. City and South London has been moving actively, so little stock being required to change the quotation one way or the other. On the week, the price shows a drop, allowing for the dividend deduction. Central London Deferred fell 5, and is amongst the very few stocks to show a bad fall since last week. The report showed no new favourable points, and people who have been holding in the hope of good news sold their stock. Other electrical issues are steady, but it is something to be able to report that, at all events, the tone of the market is fairly firm, with the exception of Central London stocks.

The Canadian-Mexican group is principally noticeable for a further improvement in the prices of Mexican Light and Power Bonds. The 5 per cent. 1st Mortgage Bonds have risen practically to par, being up to 97½ *ex* dividend, and the Preferred and Common shares have advanced. Mexico Tramways are also better, but Sao Paulo shares have gone back 2. United Electric Trams of Monte Video shares continue to drop. British Columbia Electric Preferred, allowing for the dividend, is rather harder, and the inquiry for good prior-charge stocks is still a feature.

Babcock & Wilcox shares have dwindled a little amongst the manufacturing issues, and India-Rubber Preference fell ⅛. Callender's Ordinary hardened to the extent of 5s., and this market generally, while showing firmness, is very quiet. There is not much doing in rubber, but the strength of the raw material imparts steadiness to the market in the shares, which has been helped by good results obtained at the Antwerp sales last week.

The movements in Home Electricity Supply shares are mainly due to the marking of prices *ex* dividend. Here we may repeat that in such cases as those in which a fall in price is represented practically by the amount of the dividend, no drop is registered in our lists overleaf as having occurred, because the actual alteration in value is more nominal than real.

South Londons have been weak, losing $\frac{3}{16}$, but Edmundson's Preference are ¼ higher, and Folkestones have been in demand. The improvement in Edmundson's Preference serves to draw attention to the fact that the Edmundson's guarantee of dividend to the Urban Company ran out at the end of last year.

Anglo-American Telegraph stocks hardened up after the meeting, the chairman's speech being considered so strong an argument in favour of agreement with the Western Union Company that little reasonable opposition could now be expected. The sticking point, we take it, for those who are against the agreement is the necessity which the latter will entail for parting with the painfully-acquired million pounds fund which the Anglo-American Company saved for cable renewals, but the chairman dealt with this subject in a way that should resolve the fears raised on this score.

American Telephone and Telegraph capital stock has fallen 3 points and MacKay Companies Common went down 4. West India and Panama Preference have been moving in opposite directions, the seconds gaining at the expense of the firsts. Western Union Telegraph bonds of both classes have hardened.

Prominent features of strength have been provided by National Telephone stocks and shares. The latter recovered their dividend deductions in all three cases, and the Deferred stock did the same, so there is really a rise of £3. These advances are due to the satisfaction felt with the statements made at the meeting the other day, while the forced selling of the Deferred stock has come to an end. Chili Telephones and United River Plates are also a firm market.

For Sale.—The Rugby School Electric Lighting Co. have for sale a quantity of electrical generating plant. Tenders are invited for the purchase of the undertaking of F. A. Glover and Co., electrical engineers, carried on in London and branches. **See our advertisement pages in this issue.**

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5⅛	5⅛	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	9 — 10	..	4 10 0
Do. Second 6 % Pref.	10	6	6	10¼ — 10½	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —103	..	4 7 5
Brompton & Kensington, Ord.	5	10	10	8 — 8⅛	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7⅞ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5	3⅞ — 4⅛	..	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛	..	4 7 10
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅝ — 4½	..	5 5 11
Do. Do. 4 % Deb.	100	4	4	94 — 98	..	4 1 8
Chelsea, Ord.	5	4½	5	4 — 4½	..	5 11 1
Do. 4½ % Deb.	Stock	4½	4½	98 —100	..	4 10 0
City of London, Ord.	10	7	7	12 — 12½	..	5 12 0
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 0
Do. 5 % Deb.	Stock	5	5	119 —123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First & 1882 Mort. Deb.	Stock	5	5	89½ — 91½	..	5 9 3
County of London, Ord.	10	5	5	7⅜ — 7⅞ xd	..	6 7 0
Do. 6 % Pref.	10	6	6	11 — 11½ xd	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	108 —110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	2/16 — 1/8	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2/4 — 2/2	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	5⅛	6	4⅛ — 4⅜	+ 1/8	6 6 4
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅛	..	4 15 3
Do. 4½ % First Deb.	100	4½	4½	95 — 98 xd	..	4 11 10
Hove	5	8½	9	6¾ — 7¼	..	6 4 2
Kensington & Knightsbridge, Ord	5	8	9	6⅞ — 7⅛ xd	..	6 0 0
Do. 4 % Deb.	Stock	4	4	91 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	2	1⅝ — 2	..	3 0 0
Do. 6 % Pref.	5	6	6	4⅜ — 5	..	6 0 0
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	5	5	3⅞ — 4⅛	+ 1/8	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	100 —105	..	4 5 9
Do. 3½ % Mort. Deb.	Stock	3½	3½	84⅛ — 87½	..	4 0 9
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96½ — 98½	..	4 11 5
Newcastle-on-Tyne	5	4	4	3⅜ — 3⅝ xd	..	5 3 3
Do. 5 % Pref., Non. Cum.	5	5	5	3⅞ — 4⅛	..	5 14 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 — 104	..	4 16 2
Notting Hill	10	7½	8	.. — ..	..	6 5 6
Oxford	5	7	7½	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	8⅝ — 9⅛ xd	..	5 8 1
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛ xd	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	84½ — 86½	..	4 0 11
Smithfield Markets, Ord.	5	Nil	Nil	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	2⅜ — 3	— 1/16	6 13 4
Do. 5 % First Mort. Deb.	100	5	5	98½ —101½	..	4 18 6
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1½	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	5	½ — 1	..	..
Do. 5 % Cum. Pref.	5	5	5	2½ — 3	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 89	..	5 1 2
Westminster, Ord.	5	10	10	7⅞ — 8½	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅜	..	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 4 4
Calcutta, Ord.	5	8	8½	6⅜ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅛ — 5⅜	..	4 13 0
Calgary Power, 1st Mort. Bds.	100	5	5	96 — 98	..	5 2 0
Canadian Gen. El. Com.	$100	7	7	111 —116	..	6 0 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 13 10
Cordoba Lt., Power and T., Ord.	1	2	3	3/8 — 7/16	..	3 8 4
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	..	6	94 — 96	..	6 5 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	84½ — 87½	..	5 14 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	86 — 88	— ½	5 13 8
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	Nil	1/16 — 3/16	..	..
Do. 6 % Pref.	1	6	6	13/16 — 15/16	..	8 6 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	2⅜ — 3½	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	95 — 97	..	5 3 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	89 — 90	..	5 11 1
Mexican Lt. & Power, Common	$100	4	4	88 — 90	+1	4 9 0
Do. 7 % Cum. Pref.	$100	7	7	110 —112	+1	6 5 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96 — 98 xd	+1½	5 2 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	6	7	171 —175 xd	..	4 0 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5	44 — 46	..	10 17 4
River Plate, Ord.	Stock	9	10	218 —228	..	4 7 9
Do. 6 % Non-Cum. Pref.	Do.	6	6	107 —114	..	5 5 3
Do. 5 % Deb. Stock	Do.	5	5	101½ —103½	..	4 16 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	4	119⅛ —121½	..	3 5 10
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99 —101	..	4 9 1
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	Nil	Nil	1⅛ — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	..	6	108½ —110½	..	5 8 7

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	Nil	7⅜ — 7⅝	..	Nil.
Do. 5 % Deb. Red.	Stock	5	5	98 —100	..	5 0 0
American Telep. & Teleg., Cap.	$100	8	8	139 —141	—3	5 13 6
Do. Collat. Trust	$1000	4	4	94 — 96	..	4 3 4
Anglo-American Telegraph	Stock	3⅝	3⅝	67 — 69 xd	— ¼	5 8 8
Do. 6 % Pref.	Do.	6	6	111½ —112½	+ 5/8	5 6 8
Do. Def.	Do.	25/-	30/-	25/8 — 26/8	+ 1/4	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —103	..	4 17 1
Chili Telephone	5	8	7	6⅞ — 7⅛ xd	+ 1/16	4 18 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Cuba Telegraph	10	6	6	10¾ — 11	+ ¼	5 9 1
Do. 10 % Pref.	10	10	10	17¾ — 18¼	..	5 9 7
Direct Spanish Telegraph, Ord.	5	4	4	3¾ — 4	..	5 0 0
Do. 10 % Cum. Pref.	5	10	10	8⅝ — 8¾	..	5 14 3
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable	10	4½	4½	7⅝ — 8⅛	..	5 7 5
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7	136 —139	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	84 — 86	..	4 1 5
Do. 4 % Mort. Deb.	Do.	4	4	101½ —103½	+ ½	3 17 4
Eastern Extension	10	7	7	13½ — 13⅝	..	5 1 10
Do. 4 % Deb.	Stock	4	4	100 —102 xd	+1	3 18 5
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99½ —101½	..	3 18 10
Globe Telegraph and Trust	10	5⅞	5⅞	10⅜ — 11½	..	5 4 5
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 8 11
Great Northern Telegraph	10	18	18	31 — 32	..	5 12 6
Indo-European Telegraph	25	13	13	56½ — 58½	..	5 11 1
Mackay Companies Common	$100	4	5	88 — 90	—4	5 11 1
Do. 4 % Cum. Pref.	$100	4	4	75 — 77	..	5 3 11
Marconi's Wireless Telegraph	1	Nil	Nil	2⅛ — 2¼ xd	+ ⅛	..
Monte Video Telephone, Ord.	1	6	6	⅞ — 1	..	6 0 0
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 10 4
National Telephone, Pref.	Stock	6	6	102½ —104½ xd	..	5 14 10
Do. Def.	Do.	6	6	119 —122 xd	+3	4 18 4
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅜ xd	+ ⅛	5 11 7
Do. 6 % Cum. 2nd Pref.	10	6	6	10 — 10⅜ xd	+ ⅛	5 11 7
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅜ — 5⅝ xd	+ ⅛	4 8 11
Do. 3½ % Deb.	Stock	3½	3½	98 —100	..	3 10 0
Do. 4 % Deb.	Do.	4	4	98 —100	..	4 0 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	102½ —103½	— ¼	4 7 2
Oriental Telep. and Elec.	1	8	8	1⅜ — 1⅛	..	4 8 3
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅜	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99 —101	..	3 19 3
Reuter's	8	5	5	8⅜ — 9⅛	..	4 7 9
Submarine Cables Trust	Cert.	6	6	131 —134	..	4 8 11
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	98½ —100½	..	4 9 7
United River Plate Telephone	5	8	8	7½ — 7⅞ xd	+ 1/16	5 6 8
Do. 5 % Cum. Pref.	5	5	5	5⅞ — 5¼	..	4 10 11
West Coast of America	2½	2½	2½	1⅜ — 1⅝	..	6 5 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	97½ — 99½	..	4 0 5
West India and Panama Teleg.	10	Nil	3/4	2⅜ — 2⅞	..	2 12 2
Do. 6 % Cum. 1st Pref.	10	6	6	10½ — 10⅝	+ ⅛	5 12 11
Do. 6 % Cum. 2nd Pref.	10	14½	6	9¾ — 10¼	+ ¼	5 17 1
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7	13⅜ — 14½	..	4 18 3
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4 % Bnds. A	$1000	4	4	106 —109	+1	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	+ ½	4 7 5

* Unless otherwise stated, all shares are fully paid.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	*					
Do. 5 % Pref.	1	Nil	Nil	¼ — ⅛	..	Nil
Do. 4½ % Deb.	1	5	5	⅝ — ¾	..	6 13 4
Brit. Elec. Trac., Ord.	100	4½	4½	79 — 83	..	5 8 5
Do. 6 % Pref.	10	Nil	Nil	⅞ — 1⅛	..	Nil
Do. 5 % Deb.	10	1½	1½	3¾ — 4	— ⅛	3 15 0
Do. 4½ % 2nd Deb.	100	5	5	94 — 97	..	5 3 1
Central London Railway, Ord.	100	4½	4½	76 — 80	—1	5 12 6
Do. Pref.	100	3	3	68 — 70	—1	4 5 9
Do. Def.	100	4	4	87 — 89	..	4 9 11
Do. 4 % Deb.	100	2	2	50 — 52	—5	3 17 0
City & South London, Ord.	100	4	4	102 —104	..	3 16 11
Do. 5 % Pref., 1891	100	1¾	1½	31½ — 32½ xd	— ½	4 12 6
Do. Do. 1896	100	5	5	108 —110 xd	..	4 11 0
Do. Do. 1901	100	5	5	104 —106 xd	..	4 14 4
Do. Do. 1903	100	5	5	103 —105 xd	..	4 15 3
Do. 4 % Deb.	100	5	5	102 —104 xd	..	4 16 2
Dublin United Trams, 6 % Pref.	100	4	4	102 —104	..	3 16 7
Great Northern & City, Pr'f. Ord	10	6	6	12¼ — 13⅛	..	4 10 7
Hastings Trams, 6 % Pref.	10	Nil	Nil	⅜ — 1⅛	..	Nil
Do. 4½ % Deb.	5	Nil	Nil	.. — ..	..	Nil
Isle of Thanet Trams, 5 % Pref.	100	4½	4½	75 — 80	..	5 12 6
Do. 4 % Deb.	5	1¼	2⅛	2⅛ — 2⅜	..	4 10 11
Lancashire United, 5 % Deb.	100	4	4	77 — 82	..	4 17 7
London Elec. Railw'ys, 4 % Deb.	100	5	5	79 — 82	..	6 1 11
London United Trams, 5 % Pref.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Deb.	10	Nil	Nil	3½ — 4	— ⅛	Nil
	100	4	4	74 — 77	..	5 3 11

NAME.	Stock or Share.	Dividends for 1909.	Dividends for 1910.	Closing Quotations August 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	*					
Do. Surplus Lands	100	1	1⅛	47¼ — 47⅝ xd	— ⅛	2 17 7
Do. 3½ % Deb.	100	2⅛	2⅜	66 — 68 xd	+ ½	4 0 11
Do. 3½ % Deb.	100	3½	3½	92 — 4	..	3 14 6
Do. 3½ % Pref.	100	3½	3½	87 — 89 xd	—1½	3 18 8
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89 xd	— ¼	3 18 8
Metropolitan District Ord.	100	Nil	Nil	27⅜ — 28	+ ¼	Nil
Do. 6 % Deb.	100	6	6	145 —147	..	4 1 8
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	Nil	3¼	90 — 92	+1	3 10 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5	5½	3⅜ — 1 5/16	..	5 6 8
Do. Def.	1	Nil	Nil	7/16 — 9/16	..	Nil
Do. 5 % Pref.	1	5	5	13/16 — 1 3/16	..	4 17 0
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	102½—104½	..	4 13 8
Potteries, Ord.	1	2	2	7/16 — 9/16	..	..
Do. 5 % Pref.	1	5	5	13/16 — 15/16	+ 1/32	7 5 6
Do. 4½ % Deb.	100	4½	4½	88 — 91	..	5 18 11
South Metro. Trams, 6 % Pref.	1	3	6	1⅜ — 1⅝	..	10 3 0
Do. 4 % Deb.	100	4	4	73 — 78	..	5 15 5
Underground Elec. Railways 5 % Prior Lien	..	5	5	100½—101½	..	4 18 6
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	Nil	1	64 — 66	..	1 10 4
Do. Power House Debs.	100	..	4	101 —103	..	3 17 8
Yorkshire (West Riding), Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	Nil	Nil	2⅜ — 2⅝	..	Nil
Do. 4½ % Deb.	100	4½	4½	82 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5	5 1/16 — 5 3/16	..	4 16 5
Do. 2nd Pref.	5	5	5	4 13/16 — 5 1/16	..	4 18 9
Do. 4 % Deb.	100	4	4	94 — 96	..	4 3 4
Do. 4½ % Deb.	100	4½	4½	100 —102	+ ¼	4 8 3
Do. 5 % Deb.	100	5	5	100 —102	..	4 18 0
Auckland Trams, 5 % Deb.	100	5	5	102 —104	..	4 16 2
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11¼ xd	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	96⅜ — 98⅜	..	4 11 5
Do. 5 % 2nd Deb.	100	5	5	96⅜ — 98⅜	..	5 1 6
Brisbane Trams Invt., Ord.	5	8	8	6½ — 7	+ ⅛	5 14 4
Do. 5 % Pref.	5	5	5	5 — 5⅜	..	4 18 0
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
B. Columbia Elec. Rly., Def.	100	8	8	141 —145	..	5 10 4
Do. Pref. Ord.	100	6	6	118 —122 xd	+1	4 18 4
Do. 5 % Pref.	100	5	5	106 —119	..	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101½—103½	..	4 7 0
Calcutta Trams, Ord.	5	4½	6	5⅜ — 6⅜	..	4 16 0
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	102 —105	..	4 5 9
Cape Electric Trams	1	Nil	Nil	⅛ — ⅜	..	Nil
City Buenos Aires Trams (1904)	5	5	5	5⅜ — 5⅝	..	4 5 1
Do. 4 % Deb.	100	5	5	94 — 97	..	5 3 1
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 —100	..	5 0 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —102	..	4 18 0
Kalgoorlie Elec. Trams	1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	92½ — 95½	..	5 4 9
Do. 6 % B Deb.	100	6	5	63 — 67	..	7 9 3

La Plata Elec. Trms, Prf.	1	6	6	15/16 — 1 1/16	..	5 13 0
Lisbon Elec. Trams, Ord.	1	5½	5½	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	97 —101	..	4 19 0
Madras Elec. Tr. (1904), Deb.	100	5	5	95 — 98	..	5 2 0
Manaos Trams & Lt., 1st Deb.	100	..	5	90 — 93	— ⅜	5 7 6
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100 —102	+ ½	4 18 0
Mexico Trams Com.	$100	7	7	121 —123	+1	5 13 10
Do. Gen. Con. 5 % Bonds	..	5	5	98½ — 99½	+ ½	5 0 6
Do. 6 % Bonds	100	6	6	99 —101	..	5 18 10
Para Elec. Rlys. & Lt., Ord.	5	..	10	7 — 7⅜	..	6 15 7
Do. 6 % Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Do. 5 % 1st Deb.	100	5	5	99½—101½	..	4 18 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	3/16 — 5/16	..	..
Do. 5 % 1st. Deb.	100	5	5	101½—103½	..	4 16 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	97 —100	..	4 10 0
Rio de Janeiro Trams	$100	1	4½	116⅜—117⅜	+ ½	3 16 7
Do. 1st Mort. 5 % Bonds	..	5	5	101 —102	..	4 18 0
Do. 5 % Mort. Bonds	100	5	5	97½ — 98½	+ ½	5 1 6
Sao Paulo Tram, Lt. and P.	$100	10	10	181 —184	—2	5 8 8
Do. 5 % 1st Deb.	$500	5	5	103 —105	..	4 15 3
Singapore Trams, 5 % Deb.	100	5	5	83 — 87	..	5 15 0
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 98 xd	..	5 2 0
Un. Elec. Trams Monte Video	5	5	6	5⅛ — 6	— ⅛	5 0 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	102 —105	..	4 15 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	107 —109	..	4 2 7

MANUFACTURING COMPANIES.

Aron, Ord.	1	..	Nil	⅜ — ½	..	8 0 0
Do. 6 % Pref.	1	10	9	1/16 — 3/16	..	7 7 8
Babcock & Wilcox	1	24	26	5⅜ — 5⅝	— 1/16	6 1 0
Do. Pref.	1	6	6	1⅜ — 1½	..	4 0 0
B.I. & Helsby Cables	5	10	10	6¾ — 7⅜	..	6 15 7
Do. Pref.	5	6	6	5½ — 6¼ xd	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	+1	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 99	..	4 10 11
British Westinghouse, Pref.	3	Nil	Nil	1/16 — 1/8	..	Nil
Do. Deb.	100	4	4	59 — 62	..	6 9 1
Do. 6 % Prior Lien	100	6	6	102 —104	..	5 15 5
Browett, Lindley, Ord.	1	Nil	Nil	1/6—2/-	..	Nil
Do. Pref.	1	Nil	Nil	5/- —6/-	..	Nil
Brush, Ord.	2	Nil	Nil	⅛ — ¼	..	Nil
Do. 7 % Pref.	2	Nil	Nil	⅜ — ½	..	Nil
Do. 4½ % Deb.	100	4½	4½	58 — 62	—1	7 2 10
Do. 4½ % Second Deb.	100	4½	4½	39 — 44	..	10 4 6
Callender's Cable	5	15	15	9 — 9⅛	+ ⅛	7 18 0
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
Castner-Kellner	1	14	17½	3 15/16 — 3 15/16	..	4 17 4
Do. Deb.	100	4½	4½	102 —105 xd	..	4 5 9
Crompton & Co.	8	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	57½ — 67½	..	7 8 2

Dick, Kerr	1	6	5	13/16 — 15/16	..	5 6 8
Do. Pref.	1	6	6	1 3/16 — 1 3/16	..	5 9 7
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	Nil	1/16 — 1/8	..	Nil
Do. fully paid	5	Nil	Nil	1/8 — 2/8	..	Nil
Do. 4 % Deb.	100	4	4	67 — 71	..	5 12 8
Do. 5 % Second Deb.	100	5	5	78 — 81	..	6 3 5
Electric Construction	2	Nil	Nil	1/16 — 1/8 xd	..	Nil
Do. Pref.	2	7	7	1 1/16 — 1 1/8 xd	..	7 4 4
Greenwood & Batley, Pref.	10	7	7	7½ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	8½ — 9	..	5 11 1
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12⅛ — 12⅞	..	5 16 6
Do. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	106 —108	..	4 3 4
India-Rubber, G. & T.	10	10	10	11½ — 13½	..	7 8
Do. Pref.	10	5	5	10 — 10⅝	— ⅛	4 16 5
Telegraph Construction	12	17½	20	35 — 37 xd	..	6 7 2
Do. Deb.	100	4	4	99 —101	..	3 19 3
Willans & Robinson	1	Nil	Nil	⅛ — ⅜	..	Nil
Do. Pref.	5	1½	Nil	¾ — 1	..	Nil
Do. Deb.	100	4	4	55 — 65	..	6 3 1

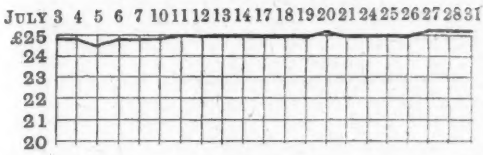
* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 3 per cent., March 9th, 1911.

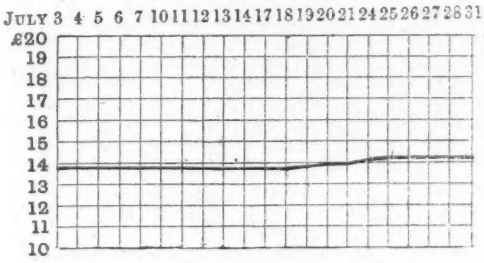
METAL MARKET.

Fluctuations in July.

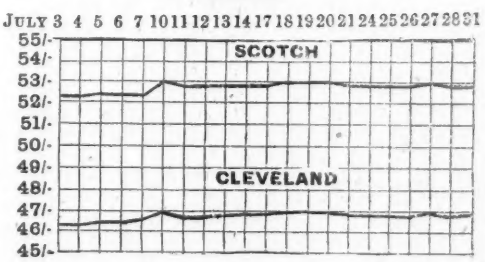
SPELTER (G.O.B's.).



LEAD (ENGLISH).



IRON.



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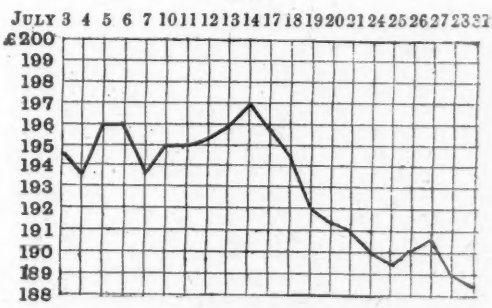
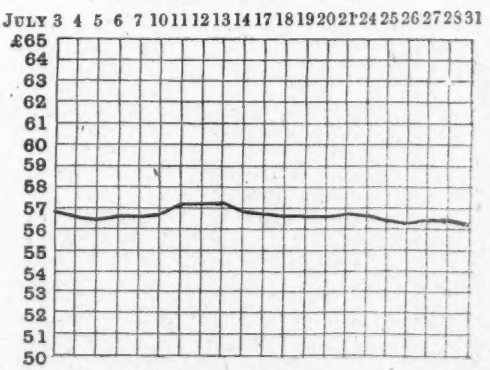


COPPER (G.M.B's.).



London Electric Railway Co.—A dividend at the rate of 1 per cent. per annum on the ordinary stock is announced, £7,500 being placed to renewals and £14,500 carried forward.

THE ELECTRICAL WORK OF THE PHYSIKALISCH-TECHNISCHE REICHSANSTALT, CHARLOTTENBURG, IN 1910.

By EDWARD S. HODGSON.

The following notes are compiled from the annual report of the Reichsanstalt for last year, kindly supplied to the writer by the authorities of the institution :—

One of the most important subjects dealt with was the determination of the E.M.F. of the Weston normal cell during some work carried out at the Bureau of Standards, Washington, by representatives of the standardising laboratories of Germany, England, France and America. The value for the E.M.F. at 20° C. was found to be 1·0183 international volts within limits of 1 part in 10,000, agreement being secured between the countries named. This value has, therefore, been adopted in Germany as from January 1st last.

A number of tests were undertaken on the energy loss in dielectrics. An experimental condenser was built up of 10 plates of solid insulating material interleaved with copper-foil sheets, the capacity being from 0·004 to 0·01 mfd. Some particulars of the method of testing are given, and the results up to now show that over a range of frequency 9 to 2,000 cycles the phase variation in the case of some substances is only to a slight extent dependent on the frequency, while in the case of others this variation is considerable. Sometimes it was also noticed that the phase difference depended on the voltage applied.

In the course of the ordinary conductivity tests on copper instituted during the past few years, it has been ascertained that with great approximation there is proportionality between temperature coefficient and electrical conductivity, *i.e.*, a very approximate formula was $\alpha_{15} \cdot c_{15} = \text{const.}$ (α_{15} temperature coefficient, c_{15} specific resistance in ohms m/mm² at 15° C.). The mean value (for all types of copper tested at the Reichsanstalt since 1905), for the constant, is $6{\cdot}7_8 \cdot 10^{-5}$. The same relation seems to apply for aluminium and iron, with, of course, other values for the constants.

The experiments on the variation of wire resistances with atmospheric humidity were continued and further tests made on coils hermetrically sealed according to the suggestion of the Bureau of Standards. Two coils were filled with petroleum and two with paraffin oil, and sealed up, measurements being taken before and after sealing. The coils filled with paraffin oil showed great constancy, while those filled with petroleum were not so constant.

In connection with the research dealing with the influence of the chemical composition and thermal treatment on the magnetic and electrical properties of iron alloys, measurements were carried out on 15 different carbon alloys, both after slow annealing and after sudden quenching at 750°, 800° and 850° C. The measurements dealing with saturation values, initial permeability, electrical conductivity, &c., are not yet concluded, but will have particular reference to the influence of carbon in permanent magnets, the best hardening temperature and durability against shock, &c.

Experiments were carried out to determine the best arrangement for testing transformer oils. The electrodes used were sometimes spheres of 10 and 15 mm. diameter, and at other times conical points and pin-points. In the case of very dry and pure oils, the breakdown voltage between pointed electrodes was somewhat lower than between spherical electrodes. The difference was scarcely appreciable, however, when the distance between electrodes was small, only becoming more noticeable at greater distances. In the case of damp oils, a higher breakdown voltage was sometimes observed between pointed electrodes than between spheres ; with pointed electrodes very irregular values in particular were often obtained for the breakdown voltage. Obviously this is partly accounted for by the strong electric field at the ends of the spheres.

Certain difficulties are experienced in the arrangements for testing the breakdown voltage on substances used for

embedding cables. If the mass is poured on to a smooth metal surface, considerable sparking takes place on the surface of the mass, resulting in the latter heating and premature breakdown occurring. In order to imitate the conditions existing in the case of cable sockets, in which filling is employed, the Reichsanstalt made iron tubes 15 mm. wide and 10 cm. long, thickened cylindrically at the ends. A 40-cm. long cardboard tube was slipped over so that the iron tube was at the middle of the cardboard tube. A 9-mm. thick brass rod was fixed concentrically in the cardboard tube by means of two corks. The pipe was then placed upright, and the filling material inserted hot, through an opening in the upper cork. After setting, the mass formed an insulating layer of approximately 3 mm. thick between the brass rod and the iron tube. The cardboard attachments filled with the mass prevented sparking from the iron pipe through the air to the brass rod when testing. About four such test pieces were prepared for each test. The breakdown voltages determined on the individual test pieces generally agreed well among themselves, which shows that the rods and tubes were sufficiently concentric.

Some experiments on the ageing of fuses, mentioned in last year's report, were supplemented by experiments on the influence of high voltage and of the filling material. Silver wires, 0·1 mm. thick and 150 mm. long, were stretched in glass tubes 15 mm. wide and 200 mm. long, the tubes being filled with dry sand. The normal current density was 4 amperes. With this current the mean of the temperatures along the wire was approximately 230° C. A number of these fuses were loaded with 4 amperes, and others with 2 amperes A.C. at 50 cycles. Tinfoil was pasted round the glass tubes, and an alternating potential difference in some cases of 4,800 volts applied between tinfoil and fuse wire; in other cases the potential difference was 600 volts, and in a third group no voltage at all was applied. The resistance of the fuses was measured from time to time in the cold state. The fuses loaded with 4,800 volts and 4 amperes showed a rapid increase of resistance to twice the amount and fused within 10 days. In the fuses loaded with 2 amperes and 4,800 volts, resistance increase and fusion proceeded less rapidly. This increase of resistance is attributed to powdering of the wire. In the case of the fuses loaded with 4 amperes and 600 volts the resistance increased about 10 to 20 per cent. in the course of eight months, and fusion did not occur. No perceptible increase of resistance occurred in the remainder of the fuses. It appears that overloading fuse-wires in enclosed tubes causes less corrosion of the wires than when they are stretched in the free atmosphere. In the latter case the circulation of the air caused by the ascending heat produces oxidation.

In connection with the tests on glow lamps, mention may be made of a series of nine 25-C.P. 116-volt metal-filament lamps which were run on D.C., the useful life of these being 7,500 hours.

Some experiments were made to determine the amount of water absorbed by certain insulating oils, and in the course of these it was found that the product termed commercially "transformer oil" absorbs but slightly more water than petroleum. Absorption of water at 18° C.; paraffin oil, 0·003 per cent.; petroleum, 0·005 per cent.; benzol, 0·05 per cent.

A PORTABLE CURRENT TRANSFORMER.

For some years the Dietze "Anleger," or portable current transformer, has been recognised as a useful addition to many test room equipments for both alternate current and direct-current work, and some particulars of its present form, as made by Messrs. Hartmann and Braun, will be of interest. It is made up in three or four sizes, of which the smallest is shown in figs. 1, 2 and 3. This pattern is intended for low voltage circuits, and is capable of embracing a conductor not exceeding 38 × 20 mm. in dimensions.

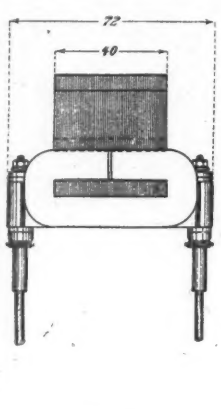


Fig. 1.

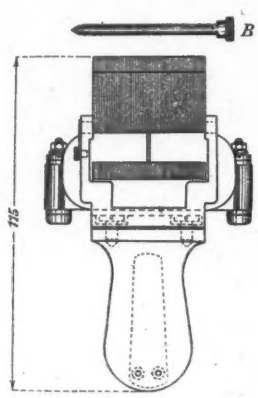


Fig. 2.

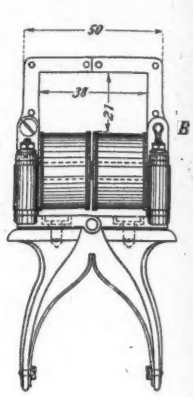


Fig. 3.

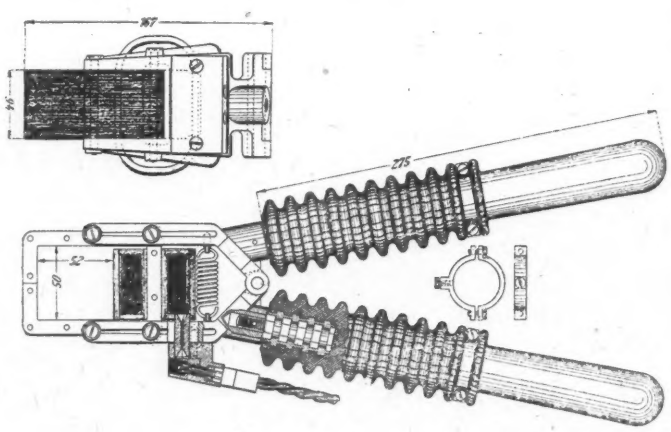


Fig. 4.

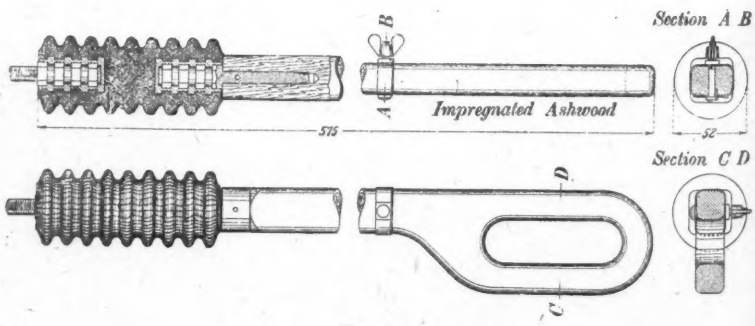


Fig. 5.

The method of using the instrument consists in opening the jaws of the laminated iron-core by pressing the handles together and then slipping the cable or conductor through the opening thus formed, and re-closing the jaws. An ammeter of the hot wire or moving iron type is connected by flexible leads to the coil of the instrument, and the whole arrangement is then identical with an ordinary current transformer with its ammeter, and enables the amount of an alternating current flowing in the cable to be obtained without opening or interrupting the circuit in any way.

When desired, the bolt B (figs. 2 and 3) can be withdrawn and one-half of the transformer can then be used alone as a fault tester with a telephone receiver in place of the ammeter.

A larger form of the apparatus is shown in fig. 4. This can

embrace conductors up to 50 × 50 mm. section, and at the same time can be fitted with long insulating handles which enable H.T. circuits up to 10,000 volts to be dealt with safely. As an additional safeguard earthing clips are provided halfway up the handles. Insulating extension pieces, as shown in fig. 5, can also be fitted when desired, so that the person reading the instrument can keep well away from the H.T. circuits.

A still larger type of the apparatus is also made which can embrace conductors as large as 70 × 70 mm.

Ordinary instruments can be used in connection with the transformers, though, for accuracy, they should be calibrated together with the transformer at the working frequency. A special small type of portable ammeter is sometimes supplied which can be plugged direct to the coil without the use of flexible leads, and forms an integral part of the transformer.

The smallest type of transformer (figs. 1, 2 and 3) is suitable for use with hot-wire ammeters having maximum scale readings between 50 and 200 amperes or moving-iron instruments with scales between 100 and 200 amperes. The larger types have about the same lower limits, but can be used for maximum currents of from 500 to 1,000 amperes.

When using these transformers, care has, of course, to be taken that the core joint closes up completely and that no grit, &c., introduces an air-gap into the magnetic circuit.

Amongst the useful applications to which this instrument lends itself may be mentioned the adjustment of the current of A.C. arc lamps. Without interrupting the circuits or extinguishing the lamps, a number of such lamps can be quickly tested by this means. Another common use is the determination of the equality or otherwise of the currents in the three lines of a three-phase supply where, perhaps, only one phase has an ammeter permanently connected. Again, where several transformers are connected in parallel, it is often important to know how they divide up the load and the introduction of an ammeter may considerably disturb the balance. The use of the portable transformer, however, besides being simpler, introduces practically no such disturbing effect.

Of individual occasions on which the instrument has proved its utility, some examples are given below :—

In one case a particular consumer, whose contract only permitted him to run his motors during the day, was suspected of running also at times of peak load. Without opening any connections or otherwise raising suspicion, one of these tranformers connected to registering meter was clipped round the supply mains at a convenient point and left for one week, when an examination of the record showed occasional night consumption, and so justified the suspicion.

In another case a sudden earth fault occurred on a large H.T. distribution network. One of these transformers connected to a telephone receiver was taken to the chief feeding point and applied in turn to each incoming and outgoing cable. The cables leading in one particular direction gave a much louder indication in the telephone than the rest. This was not due to the normal working currents in the cables, because the lead and return being embedded in the same core, the main currents cancel out as regards the telephone. The charging currents, however, flowing towards the fault are unequal, and these produce the sound in the receiver.

Without interrupting the general supply, one or two fuses were removed on those cables showing the strongest charging current, thus opening the meshes of the network, so as finally to leave only one cable supplying the charging current to the fault. This cable was found to lead to a particular feeding box, and on testing here again in the same way, the direction of the fault was again localised, and finally a blown fuse was reached, and close to it the faulty cable was found. The whole process, using this instrument, took only about half an hour. In cases where, owing to low voltage or smallness of the network, the charging current is too small to give reliable results, a similar unbalancing can generally be introduced artificially by earthing one of the sound mains. In direct-current networks a small pulsating or alternating current must be superposed on the main current before the test can be carried out.

In many cases of breakdown, delay is introduced by the difficulty of seeing just which fuses have blown. In this case the transformer and telephone placed around each fuse-holder or cable in turn quickly pick out those carrying no current.

The instrument has also often proved useful in tracing out cables before making complicated connections, such as are involved in large junction boxes, or in theatre lighting regulation, car controllers, &c. A small pulsating or alternating current is applied, and the cable carrying this current is then quickly picked out by means of the transformer and telephone.

The instrument is also useful in many cases of machine breakdowns. For instance, the short-circuited rotor of an induction motor developed an extra connection. The winding was opened at one point, and an alternating-current sent from one end of the winding through the fault. Half the transformer (obtained by removing bolt B in figs. 2 and 3), with a telephone receiver connected to it was then moved round the armature periphery, and the slot containing the fault was discovered in a few minutes.

The slip of an induction motor can also be readily obtained by simply clipping the transformer round one of the connecting cables between the starting resistance and the slip-rings. The rising and falling rotor current of low frequency can then be readily heard in the telephone and its frequency determined. In the case of squirrel-cage rotors the same result can be obtained by clipping one of the stator supply cables, when it will generally be possible to distinguish the slow rotor pulsations by their reaction on the stator currents.

Numerous other applications could be described, but the above indicate the scope of the work that has been done by this simple instrument.

LIGHTNING PHENOMENA.

In a paper on "Some Unexplored Fields in Electrical Engineering," recently presented at a joint meeting of the Franklin Institute and the American Institute of Electrical Engineers, Dr. C. P. Steinmetz said that lightning was one of the most important uninvestigated phenomena of electricity. In the early days lightning was explained as a discharge from the clouds. The clouds being positively, and the ground negatively charged, a spark jumped from the clouds to the ground.

Speculations were made as to how the clouds became charged, and as then the only method of producing electricity was by friction, it was said it might be the friction of the vapour through the air, or the rain-drops through the air, or some other form of friction. That explanation used to appear satisfactory, but with our present knowledge of dielectric phenomena, it was not any more satisfactory.

It was thought that lightning was the discharge from the cloud to the ground. That meant that the electric field between the cloud and the ground must be beyond the breakdown strength of air. In a uniform field the breakdown strength of air was about 75,000 volts per inch, or nearly 1,000,000 volts per foot. Even if the cloud were only 1,000 ft. above ground, this would require 1,000,000,000 volts. If there were an electrostatic field between the cloud and the ground of 1,000,000,000 volts extending over the whole area of the thunder cloud, this would represent such an immense amount of electric energy that it was inconceivable how any reasonable source of energy could produce it ; or how it could exist without having a destructive effect far beyond anything known of lightning. Furthermore, a uniform field could not well exist between clouds and ground on account of the unevenness of the ground surface.

Another conception was not a uniform electrostatic field, but an ununiform field, like that of the discharge between points. With long striking distances between points the average gradient was about 170,000 volts per foot. This would require only 170,000,000 volts between a cloud 1,000 ft. high and the ground. This would be more reasonable. It would not require such an unreasonably vast amount of stored electric energy. But they knew that in such an ununiform field the spark was preceded by a brush discharge covering more than half the distance. Thus, lightning should be preceded by a brush reaching down from the cloud and up from the ground for several hundred feet. Now, such an enormous brush had never been observed, and was inconceivable ; the brush discharges occasionally observed at points during storms were only a few inches long. Furthermore, a 300-ft. brush was inconceivable, because the resistance of the ground was not low enough to conduct the energy necessary to maintain such a brush discharge.

Furthermore, most of the lightning discharges were not between the cloud and the ground, but were internally in the clouds, frequently reaching the length of several miles. So one saw that the explanation of the lightning as a spark discharge similar to the discharge of the friction machine appeared plausible in the early days, but with our present knowledge it was not tenable any more.

The lightning discharge could not be considered as a simple electric rupture, in the same way that an overloaded beam might break mechanically, but as an equalisation of internal stresses, much as a piece of hot glass that was rapidly chilled, and thereby full of internal compression and tension strains, might suddenly break all over by the internal stresses. So, with their present knowledge, they must consider as the most probable explanation—although not certain by any means—that the lightning discharge was the phenomenon of the equalisation of internal electric stresses in the cloud, and was analogous to the splintering or breaking of an unevenly stressed brittle material like glass.

The question then was how did those uneven electrostatic stresses originate in the cloud, and how did they reach such values as to cause internal equalisation by rupture? If there had been produced a very highly unequal distribution of voltage in the electrostatic field of the cloud, it was easy to see how a discharge could pass along miles of cloud without such unreasonably great potential differences as would be required for a direct discharge across space, just as from a scratch in a poorly-annealed glass plate cracks might run all over the plate, splintering it in all directions. Let them assume that the potential distribution in the cloud became very uneven. If then at some point the potential gradient became higher than the disruptive strength of air at this point, a local disruptive discharge occurred, perhaps only a few inches in length. This discharge equalised the potential gradient within its path, and thereby increased the gradient at the end of the discharge. If this gradient was already fairly high, it rose beyond the disruptive strength of air, and thereby the discharge extended farther along the discharge path, but the voltage equalisation resulting therefrom still further increased the potential gradient ahead of the discharge, and in this manner the equalising discharge extended further and further, possibly for miles, side discharges issued from it, or ran into it, until finally cloud regions were reached where the initial potential gradient was very low and the discharge gradually tapered down.

But where did the initial voltage come from, and how did it become uneven?

It was not so difficult at least to make a preliminary estimate of the building up to very high and uneven voltage distribution in the clouds as soon as they had assumed some initial voltage. They did not know where the initial voltage came from, but they must accept the fact that there was normally a voltage gradient in the air, a potential difference between different altitudes which

might amount to 100 volts or more per foot. In the air 100 ft. above the ground there might be a potential difference against ground amounting to thousands of volts. If they brought a wire up to there they did not carry a current down, they merely carried the ground potential up, but by a carefully insulated electrostatic voltmeter they could measure these potential differences. Possibly this potential gradient in the atmosphere might even be of cosmic origin, the earth having a high negative potential against our solar system, against the universe, which would mean that there must be a positive voltage gradient from the surface of the ground into space.

If condensation took place in the higher regions of the atmosphere, rain drops formed, minute drops at first, which necessarily must be at the potential of the air in which they formed. That meant they had a potential difference against the ground, and therefore an electrostatic charge against the ground corresponding to this potential difference. Assuming now that many of these minute rain drops conglomerated to larger drops, it meant that many small condensers conglomerated to one condenser, which was somewhat larger in capacity than each component, but very much smaller in capacity than the sum of the capacities of its components. But it contained all the electrostatic charges of the rain drops, and at the much smaller capacity the same charge gave a higher potential difference. Suppose 1,000 small rain drops conglomerated into one large one. This had 10 times the capacity but 1,000 times the charge, hence 100 times the voltage. Conglomeration of minute drops into larger ones thus must give a great increase of potential differance against ground.

The clouds were by no means uniform in density, and where the density was greatest, conglomeration of condensed drops took place to a much greater extent, building up to a much higher voltage, and thereby between the parts of the cloud of different density, the light and the dark portions, potential differences must appear and increase with increasing condensation, until somewhere the disruptive gradient was passed, equilisation occurred by a lightning discharge, and then the same play was repeated again and again.

Lightning discharges then were the result of the voltage unequalities produced in the clouds by the unequal rate of conglomeration of rain particles due to the unequal cloud density.

In agreement with this was the fact that heavy lightning strokes were usually followed by a heavy downpour of rain; in reality they were preceded and caused by it, but it took time for the raindrops to come down.

Let them assume now that the process was reversed, and after conglomerating to high voltages the rain-drops evaporated again. Since gases apparently did not carry electrostatic charges, the rapidly dwindling rain-drop retained its entire charge, hence must rise in potential, and finally must discharge, and this progressive evaporation of the rain-drops must also result in the building up of potential differences and therefore the formation of lightning, and this might explain the two forms of lightning, that accompanying rainstorms and thunderstorms, and the so-called "heat" lightning.

The former was the result of condensation and conglomeration, the latter the result of evaporation of rain-drops.

One saw then that in this field, which was not merely of theoretical interest, but of high industrial and general importance, their knowledge was still very limited; it was a fairly unexplored field of electrical engineering and electrical science. It was a branch of electrostatics, of the phenomena of the dielectric field. The phenomena of the dielectric field they could not very well call unexplored, because there had been a great deal of investigation in the early days, and volumes had been written on it. Many of them might still remember the early days when the text-books of electrical engineering started with the theory of the distribution of the electric charge, investigated the electric density on an ellipsoid and all that sort of thing. All this had now pretty well vanished from electrical engineering text-books. With the development of electrical engineering, electrostatics became of less interest and were thus neglected. Only in recent years, when they had in transformers and transmission lines reached voltages higher than in almost any electrostatic machine, and those not of a negligible power, but of a very large power, the field of electrostatics had become a very important one and had to be studied again.

It was seen that in the study of electrostatics the conceptions of the work of former days were untenable, from their present point of view; they could not conceive of the dielectric phenomena as a charge on the conductor surface, they knew there was not an electric charge on the conductor, the dielectric energy resided not on the conductor surface, but in the space around the conductor, in the dielectric field, and the so-called "charge" was nothing but the termination at the conductor surface of the electrostatic field in space. It was the electrostatic or dielectric field which they must consider as representing the phenomena of electrostatics, in the same way as Faraday had shown them with the magnetic field.

The old conception of the electrostatic charge on the conductor had been the cause of the far greater difficulty which they found in dealing with even simple phenomena of electrostatics, compared with the simplicity with which even apparently complex phenomena were treated by the conception of the lines of magnetic force.

One must then abandon the conception of the theory of electrostatics of the early days—which was still largely used in theoretical text-books—as incorrect and useless. Capacity then was not the capability of the conductor to store electric quantity, but was the ratio of the number of lines of dielectric force to the E.M.F. which produced them, just as permanence was the ratio of the number of lines of magnetic force to the M.M.F. which produced them; the "charging current" was no more a current charging the conductor with electricity than the "inductance voltage" was a voltage charging the conductor with magnetism. The former as "capacity current" supplied the energy stored in the dielectric field, just as the inductance voltage supplied the energy stored in the magnetic field, and dielectric and magnetic phenomena were very largely analogous and treated in the same manner and with the same simplicity.

This was not possible with the conception of electrostatic charges, and even simple problems such as the calculation of the capacity and the mutual capacity of parallel conductors, became so complicated that the most satisfactory method of their calculation was not to calculate the capacity at all, but to calculate the corresponding inductance and derive the capacity by the relation, that capacity × inductance equalled the square of the velocity of propagation, which, in space, was the velocity of light (3×10^{10}).

It would thus be seen that in this field, which was of the highest industrial importance now, where they had, in transmission lines, reached voltages which approached those of lightning, they were only just in the beginning of an intelligent understanding, an insight into the phenomena.

SOME NOTES ON INSULATING OIL.

Prof. Hughes was one of the earliest investigators of the properties of oil as an insulator, and the results of his experiments were given in his paper before the Institution of Electrical Engineers (1892, Vol. XXI, page 224). Steinmetz also, about the same time, carried out important experiments in this field. At that time, oil was not used to any great extent for insulating purposes; in fact, it is within comparatively recent years that its adoption has become universal.

It is in even more recent years that this material has received from engineers some of that notice which it demands: but even now, it would appear, its properties are not so familiar as they should be. This would apply rather to the users of, than to the designers of, gear in which oil plays so important a part.

It is the purpose of the following notes to point out the necessary qualifications for good oil, the methods adopted for testing these, and the means for their being retained.

These notes will refer to oil in its two chief uses—that is, in transformers and oil switches.

All common oils, so far as insulating properties and dielectric strength are concerned, would fulfil the requirements called for in transformer and oil-switch work; but other considerations physical and chemical have eliminated the oils formerly used, and it is now agreed that mineral oils best meet practical conditions. Formerly animal and vegetable oils, especially resin oil, were used, but these oils have a great affinity for oxygen, and this combination produces fatty acids in the oil, while at the same time the oil congeals and becomes sticky. For these reasons the use of animal and vegetable oils has been discontinued, and mineral oil, the best grades of which do not exhibit these properties, is now used exclusively.

The two most important properties of oil, and those which make its use possible, are resistance and dielectric strength. These properties are allied but distinct, as Fessenden says: "A thing insulates because it is possessed of two distinct properties, first, the ability to stand the mechanical and electrical stresses due to voltages used; secondly, because it is such a poor conductor that a negligibly small current can flow through it and leak away. In other words, it will neither allow current to break through it nor steal through it. The first property is called by Maxwell the 'dielectric strength of the insulator,' the other is called its ohmic resistance. The two together form its insulating power." Oil for use in transformers and oil switches should have high dielectric strength, and to ensure the use of an oil possessing this quality a test should be made on a sample.

The test is carried out by the immersion in the oil of two electrodes and applying to these an increasing voltage until breakdown occurs.

Several precautions are necessary in making the test. The electrodes should be bright, smooth spheres about ½ in. in diameter. Points and plates seem to give varying results. The spheres should be kept bright and clean, so that no foreign particle can reduce the gap and give false results. The spheres should be kept submerged the same depth in all comparative tests, as the height of oil above the gap influ-

ences the breakdown voltage. The time during which the voltage is applied should be the same in all tests, and the temperature of the oil should also be the same in all cases. Bubbles of air in the oil must be excluded, and care should be exercised to keep the oil vessel clean, as a piece of dust or hair lining up with the spheres will give an apparently low breakdown voltage, as has already been mentioned. Due

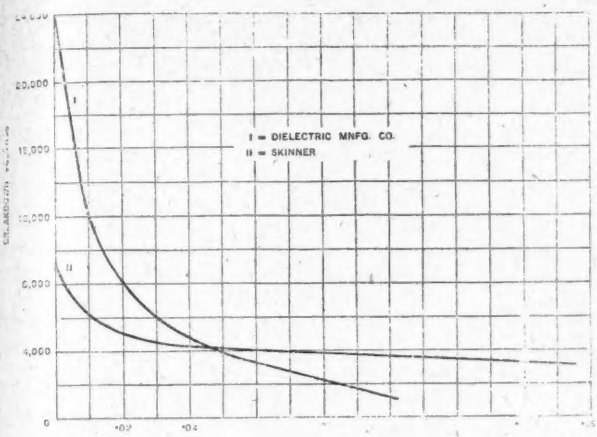


Fig. 1.—Effect of Moisture on Dielectric Strength.

to small amounts of moisture being present in some oils, a discharge is got at comparatively low voltages, but the oil is thereby dried out, and the real dielectric strength can then be ascertained. This feature is not so much in evidence with the best oils.

Carbon is formed at each rupture, and if this is allowed to concentrate at the electrode, low readings will be got; in any case, when the oil becomes much discoloured, due to much carbon being present, the dielectric strength will drop rapidly, and a new sample of oil must be used. As nearly as possible, a sine wave form of E.M.F. should be used for testing, which necessitates field regulation on the generator for varying the voltage instead of the use of resistance in circuit. Of course, a peaked wave would break down the insulation at a lower virtual voltage than a sine wave with equal R.M.S. value. Elihu Thomson first showed that oil is not as good an insulator at low frequencies as at high ones, but throughout the range of commercial frequencies the factor is negligible.

Oil tested in the manner described should not break down at less than 20,000 volts with 2 mm. gap.

Moisture present in insulating oils reduces the dielectric strength alarmingly. Fig. 1 gives curves showing the fall in dielectric strength due to the presence of moisture in varying quantities, and it will be noticed that it is the small percentages that make the great differences in dielectric strength.

In testing oil samples, one cannot well estimate the percentage of water present (in getting the results from which the curves in fig. 1 were constructed, dry oil was first tested, and then known quantities of water were added), nor is this necessary, since if there were present more than the slightest trace (such as would dry out quickly), the oil would be useless.

These oils evaporate slightly at 100° C., so that one cannot discover the moisture present by condensing the water evaporated.

Dehydrated copper sulphate put in with the oil and well shaken up with it shows a bluish tinge on becoming hydrated through the presence of moisture.

A rough method of testing for moisture is to plunge a red-hot wire into the oil, when, if moisture is present, a crackling sound will be heard. This will only detect comparatively large quantities of water.

Acids and alkalis should be guarded against, and to test for these, a small quantity of oil should be taken in a test tube and shaken up with a little distilled water. Any acid or alkali present will be taken up by the water and can be tested for by litmus paper.

Insulating oils should have a high flash point and burning point. This is obvious, as an oil having a low flash point would be dangerous to use. Heavy oils are not so inflammable as is often supposed; good transformer oil will readily quench a lighted torch, if this is pushed beneath the surface. It is possible, however, that the lighter oils may be present in small percentages in the heavy oil, and these small quantities reduce the flash point abnormally. For this reason it is

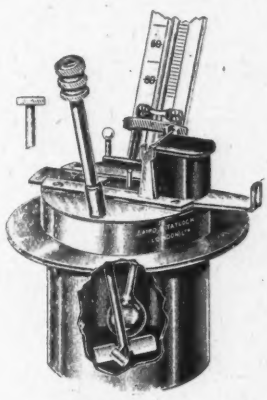
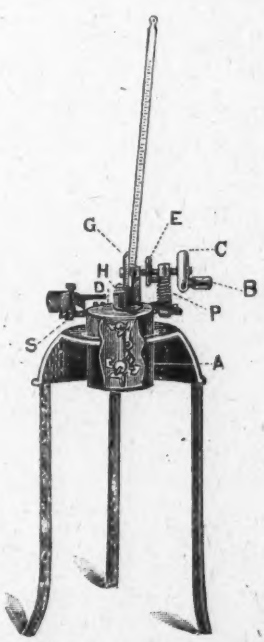


Fig. 2.—Abel's Flash-Point Apparatus.

preferable to use the closed-cup rather than the open-cup method when testing for flash point. Normally, the temperature of the oil in use would not exceed 60° C., but it is possible, in case of faulty winding in a transformer or poor contact in a switch blade, to have this limit far exceeded. An insulating oil should not flash at less than 180° C. or burn at less than 200° C.

The flash point of an oil is that temperature at which gases are given off at such a rate as to form an explosive



A, Brass oil cup; B, C, Hand-wheel for operating stirrers; D, Test flame; E, Mechanism for moving sliding cover and depressing test flame; G, H, Gears for driving stirrers; F, Spring for replacing sliding cover; S, Sliding cover.

Fig. 3.—Gray's Flash-Point Apparatus.

mixture with the surrounding air. The burning point is that temperature to which the oil must be raised so that the liquid oil takes fire and continues to burn on the application of a flame to the surface.

There are several types of apparatus for making these tests on oil. The earliest type of flash-point apparatus had an open cup in which the oil was heated. This was succeeded

by Abel's apparatus, in which the cup was closed, and the operation of uncovering the cup also depressed the flame of a small lamp for the purpose of flashing. This form (fig. 2) is the one recommended by the Board of Trade in the Petroleum Act, 1879. A modification of this instrument is the Abel-Pensky, in which a clock-work arrangement is fitted to uncover the cup and apply the flame. The Pensky-Marten apparatus has a smaller water bath and differs from the Abel form in the arrangement for moving the flame. Gray's apparatus, fig. 3, is somewhat similar to the Pensky-Marten.

To obtain good results in testing the flash point of oils it is necessary to take several precautions.

The oil must not be heated too quickly, or the vapour being driven off rapidly will give a low flash point. This is taken care of to a great extent by the water bath.

The quantity of oil used must be the same in all tests. The more oil used, the more vapour is driven off, and hence

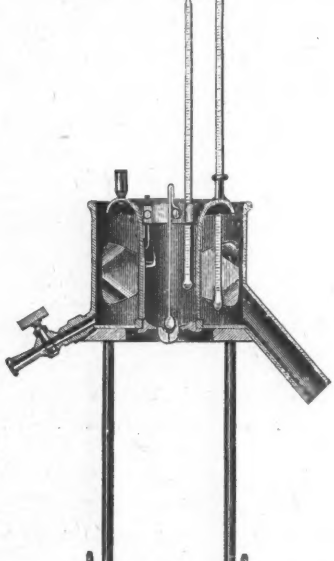


Fig. 4.—Boverton-Redwood Viscometer.

the lower the flash point. A level point will be found on the inside of the cup, and the oil should reach to this level.

A standard size of cup should be used. In the testers named it is about 2½ in. in diameter.

If a shallow cup were used, the greater surface would give more rapid evaporation and lower flash point.

The size of flame should be small and constant. A gauge is usually fixed on the apparatus to set the flame to. A large flame would cause local superheating of the oil.

It is necessary that insulating oil should have a more or less fixed viscosity. In transformers, the oil cools the winding by convection, and hence an oil too viscous would not circulate rapidly enough to ensure proper cooling. On the other hand, in an oil switch, an oil that is not sufficiently viscous is too readily displaced by the arc, though, if the oil were too viscous, it would interfere with the contact of the brushes.

For these reasons it is advisable to use separate oils for switches and transformers, though it is possible to obtain an oil which will fulfil both requirements pretty well.

There are a number of forms of apparatus for testing the viscosity of oils (viscometers). In the Boverton-Redwood apparatus, fig. 4, there is a metal cylinder with a small agate jet at the bottom, which is closed by a small brass sphere carried on a brass rod. The cylinder is kept at a proper temperature by an outer compartment containing water, which is heated by a burner, and there is an arrangement of vanes for keeping the water at a uniform temperature throughout the bath. In addition to this type there are Saybolt's, Englier's and Colman and Archbut's viscometers. Some of these instruments use oil and some water as the standard of viscosity, and the viscosity of the sample is proportional to the time taken to run a definite quantity of oil or water through the meter.

The viscosity of transformer oil should be between 8 and 12, and for oil-switch work between 12 and 16 at 20° C., using water as the standard.

An evaporation test on insulating oil is not so important as flash-point and dielectric tests, but it is advisable to test occasionally for evaporation on oil intended for use in transformer work. This can be done by heating about 3 grammes for about 10 hours at 100° C. and calculating the percentage loss of weight. This should not exceed 2 per cent.

A cold test should be made on oil for use in oil switches, as, owing to the exposed position sometimes allotted to this type of apparatus, it is possible for the oil to freeze, and so put the switch out of action. A sample of the oil when placed in a freezing mixture should readily form drops.

Considerable care should be exercised in the handling of insulating oil. The oil is practically non-hygroscopic, but if open cans are left lying about exposing a large surface of oil to the atmosphere, as the writer has seen in some shops, moisture will condense on the surface of the oil and be carried down, thus reducing the dielectric strength. Oil should be stored in steel drums so as to be perfectly dry, which might not be the case when stored in wooden casks, especially if these are left outside with rain water standing on the heads.

When it is necessary to dry out the oil, this should be done in a vacuum oven and at 80° to 90° C. If the oil is heated above this temperature for any length of time, it begins to deteriorate.—W.L.

PACKING FOR EXPORT.

[contributed.]

The system of packing goods for export must always be based on the nature of the goods, and on the conditions involved. Crockery, for example, can, without damage, be wrapped in paper and packed in hay, in any case that is strong enough to carry the weight.

Machinery which is heavy, and much of which is machined bright, presents peculiar difficulties. It must not be packed with hay, for a band of hay round a bright shaft will produce rust, as hay is naturally damp, and may produce acid which will bite into a polished surface.

Some men in charge of machinery we have seen, who will have no bright parts exposed. They paint everything. English locomotives have coupling rods polished on both sides, after the manner of some of the work of the masons of the middle ages, who carved stonework where it has ever since been invisible. American coupling rods are black on the rear side. Most men still prefer to have many parts got up bright, and in many machines there must of necessity be a good deal of bright work, as, for example, in a machine tool.

Let us suppose that such an article has to be packed. How should it be done? Probably the machine will have a standard rising from a large wide-spreading base plate.

The normal packer stands this machine flat on the floor of a stout packing case, and thinks he has done well. Now had that man been at some foreign port where the labour was rough—rougher even than usual—and where the sun was baking everything within an oven of high encircling mountains, and the lifting gear was not of the best, he would picture to himself that case of machinery coming down too heavily on one corner, and he would hear a corner break off that machine base plate, and perhaps, if he thought about it, he would change his ways. Such a bed plate should not be stood on a flat case bottom. On the bottom of the case should be a circle or a square of wood standing above the general level and serving to support the middle part only of the bed plate, leaving the outer part, and particularly the corners, raised well above the timber floor, so that a blow on the case corner cannot reach the machine base corner.

It is a common practice to lower a machine into its case and

then to add supports and struts to hold the machine from moving, such struts being nailed casually to the outer walls of the case by a man who cannot get down into the case, and probably fails to do his work at all perfectly.

Now properly to pack a machine, it is best built up inside a stout framing of timber—a sort of crate of outer bars carrying struts or cross-bars to steady the machine. Inside this crate or frame there is sure to be some vacant space, and into this space is built a boarded enclosure in which are packed the small loose parts of the machine.

To avoid undue size of packing it is often usual to remove some far-projecting piece, and pack this in a different position. The crate system lends itself well to this, and enables such loose pieces to be safely secured. Every part lies within the planes bounding the crate's exterior planes. When all is complete, the crated machine is lifted bodily into a packing case, and slides into it a fit. The cover is fastened down and the case is ready.

When building up the crate the intention is that the machine will stand upon the middle of its base, especially when this is of the flate plate order, and not a deep box section, which is less liable to be broken than a thin base-plate, such as the base of a shaping machine.

But the business of packing in the skeleton crate-frame must also be regarded from the view-point of the case being turned roughly over upon any one of its four sides or even upon its head. Support must, therefore, be given to take the lateral stress of any of the tumbles-over sideways. This can usually be arranged by strut pieces from the crate framing, and between the strut and the machine there may be interposed a pad of felt to soften the jar; a strut piece may also carry the upside-down weight of the machine.

A long accurate piece of machined work for the tropics, like a lathe bed, should, in the writer's opinion, be painted on its finished surfaces and protected by stout boarding and packed with well dried wood-wool all round in order to prevent shock. The paint can be removed by suitable solvents, and should be worth this trouble for the protection it affords, for a rusted lathe bed may destroy the whole machine as an instrument of precision. Large machines are not usually packed whole, but are pulled down and packed in sections.

If not painted with ordinary paint, small bright parts and finished holes may be well coated with vaseline. Wrapping with jute cloth is sometimes resorted to for protection; this should follow a wrapping of vaseline paper. All small parts, such as are promiscuously heaped into cases with the pattern shop sweepings, should be wrapped first in greasy and in plain papers.

It has been suggested that particular small parts might first be packed in tin canisters or boxes. As to this, exporters must satisfy themselves that the whole of the contents of a case will not have to pay duty on the scale of the most heavily rated article. Thus in Mexico there is a very heavy duty on glass, and this practically prohibits the importation of food stuffs in glass bottles, for the bottles are weighed with their contents, and duty at glass rates is levied on the full combined weight. Exporters must always watch for these snags when packing goods or when sending compound articles—such as steel cum brass, silk cum wool—for duty on the full weight is always charged as if the higher-rated ingredient formed the whole.

When packed, a line may be painted round the case, and marked "Sling here," in the languages of the ports and railways on which the case will travel. One often sees "Sling here" on a case in a foreign port. Doubtless in time the significance of the words becomes known, but it would be as well to put it in other languages also. Weights also should be in the right system, tons, tonnes or kilogrammes, so as to give warning not to use chains too small.

It is always to be remembered that packing cases are regarded as protectors of what is inside them, and so long as the case is not broken it is assumed the contents will not be harmed. Articles which are apt to be very much damaged, however carefully packed, will sometimes travel safely in open crates fully visible to the eye and plainly showing their delicate construction.

Packing is an art with a good deal of science in it. The science consists in providing against cross breaking stresses due to shock by suitable supports and some elasticity. There is nothing better than hay packed tight; hay will pack tight where straw will not, yet it will give elasticity. It is a pity hay has faults which render its use inadvisable for many things; but for clay goods it is excellent and cannot damage them. Tightness in all packing is essential. Goods must not settle into less space as they travel, or they may chance to tumble about in the free space of the case.

Our readers being engineers, many of them will be going abroad or coming home, and may have pictures and other impedimenta to pack. Pictures should go in shallow cases, say 9 in. deep, lined with tar paper, and packed between each layer of pictures with blanket, and with tight rolls of paper between pictures in the same layer. The case should only be large enough for the largest picture. Gaps in the layers may be filled with thin books, and the whole stuffed tight, to prevent movement, with dry wood wool. The hanging rings should be removed, or they will do serious damage.

In the tropics it is often impossible to keep things dry, and anything with iron about it will be apt to rust, such as buttons, clips, buckles, &c., of clothing, ties, &c.

Before going abroad, clothing should be cleaned free from grease or any traces of perspiration.

Mildew or other parasitic growth will fasten on clothing that has been worn; for example, if a speck of food has touched a coat, there will form white mildew. Starched articles may mildew also. Woollen clothes should be packed with a few wrapped-up naphthalene balls, to keep out moth and similar insects.

Holborn Street Lighting.—At the meeting of the Borough Council last week, the report of the Special Committee of the whole Council, dated May 24th last, with regard to street lighting, again came up for consideration. The Works and General Purposes Committee, to which had been submitted the report and recommendations of the Committee of the whole Council, put forward the following observations and recommendations:—(*a*) Capital expenditure: The companies in their tender undertake for payment of a lump sum per annum to make all the improvements, supply all the new lamps, fittings and columns, and maintain a light of a certain gross candle-power, as required by the specification. The sum which the company will spend in providing the new fittings (which will become the property of the Council) is not stated, but we are informed that it will amount to about £9,000, payment of which will be spread over a period of 10 years as part of the contract amount. The estimate has been carefully examined with the specification, and it has been ascertained that it represents the reasonable cost of supplying the new lanterns, fittings and columns required to be provided, and of the work in altering and adapting part of the existing system to electric lighting. During the past year the lighting of the borough by the present system cost £6,975, whereas if the improved lighting were in force it would have cost only £6,745, after deducting £900, the proportion of this estimated capital charge. For the year 1901-2, the first complete year of the Council's existence, and before the adoption of incandescent gas lighting, the expenditure amounted to £7,537, and the amount for the past year is the lowest figure that it has since reached. (*b*) Amount of light and distribution: The difference in the amount of light proposed by the companies, which is some 20,000 C.P. in excess of that required by the specification, is accounted for by the increase proposed in the power of the lamps in certain main thoroughfares, which are partly in adjoining boroughs. This is considered desirable for the purpose of uniformity. If it were decided to retain the lamps in the side streets at the present candle-power, *i.e.*, 60 C.P., instead of the proposed 90 C.P., this would mean a reduction in the total candle-power in such streets, which comprise 1,390 lamps, from 125,100 to 83,400. It should be borne in mind, however, that this latter figure represents the minimum to which the mantles are allowed to run down, and a truer comparison would be made between 80 C.P. (the original power of the mantles when first installed), and the proposed 90 C.P. The difference in that case would amount to only 13,900 C.P. In conclusion, the Committee recommends: "That subject to the consent of the London County Council being first obtained to the form and principle of the contract, the joint and several tender of the Gas Light and Coke Co., and the Metropolitan Electric Supply Co., Ltd., dated April 11th, 1911, for lighting the streets of the borough for 10 years for the sum of £7,645 per annum, subject to the deletion of Clause 35 of the specification, and the amendment of the schedule of lighting as proposed by them, be accepted, and that the seal of the Council be affixed to the necessary contract to be prepared by the town clerk." This was passed.

Magnetic Variation.—In the annual report of Admiralty surveys for 1910 it is stated (says the naval correspondent of the *Western Morning News*) that a systematic determination of the magnetic variation in the North Sea was carried out in March by the officers of four cruisers. The results afford good values of the variation at 62 positions, enabling isogonals to be drawn with considerable accuracy.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

CUBA.—With reference to the notice which appeared in the ELECTRICAL REVIEW of June 30th last, regarding a Bill before the Cuban Legislature, in which it was proposed to increase by 50 per cent. the Cuban Customs duties on goods from countries which have not concluded, or which have not within six months of the promulgation of the Bill as Law concluded, reciprocity treaties with Cuba.

The Board of Trade are now informed that the Bill in question has been reported from the Committee of the House of Representatives to which it was referred, and was read in the House for the first time on June 9th. The principal amendments are the alteration of the proposed rate of surtax from 50 to 30 per cent.

SOUTH AFRICA.—The South African Customs Authorities have published a decision to the effect that paper tape imported in rolls for use with telegraph machines, shall be admitted free of duty if imported from the United Kingdom and shall pay 3 per cent. *ad valorem* if of foreign origin.

BAHAMAS.—A new tariff of the Bahamas, which came into force on March 28th of this year, provides that goods not separately mentioned in the Tariff and not free of duty shall be raised from 20 per cent. *ad valorem* to 25 per cent. *ad. valorem*. For further details as to the effect of this revision readers should consult the information as to the tariff rates in Bahamas published in the ELECTRICAL REVIEW of January 1st, 1909. Pumps which were formerly free of duty now pay 20 per cent. *ad valorem*.

NETHERLANDS.—The Customs Authorities have issued a decision to the effect that apparatus for separating air from the feed water for boilers is to be admitted free of duty.

PANAMA.—The Panama Government have now issued a decree to the effect that from September 1st next all articles included in the second of the General Classes of the Tariff of Panama shall be dutiable at the rate of 15 per cent. *ad valorem* instead of 10 per cent. as formerly. The Second Class of the Tariff comprises all goods except those which are free of duty, and includes electrical goods except such as might be imported under special circumstances for the Canal Commission, the Panama Railroad Co. or for irrigation.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

16,426. "Process for the electrolytic production of ammonium nitrate from hydrated nitric acid." ELEKTROCHEMISCHE WERKE G.M.B.H. (Convention date, July 16th, 1910, Germany.) July 17th. (Complete.)

16,437. "Spark plugs." J. W. MACKENZIE. (Champion Ignition Co., U.S.) July 17th. (Complete.)

16,438. "Spark plugs." J. W. MACKENZIE. (Champion Ignition Co., U.S.) July 17th. (Complete.)

16,440. "Electrical contacts." ANSCHUTZ & Co. (Convention date, November 26th, 1910, Germany.) July 17th. (Complete.)

16,456. "Electrical driving devices for sound-reproducing machines." M. KAISER. July 17th. (Complete.)

16,458. "Electrically-operated apparatus for locking railway carriages and other doors." C. LEGRAND and A. ARMEL (trading as Soc. Ch. Legrand et Cie). (Convention date, date July 27th, 1910, France.) July 17th. (Complete.)

16,468. "Electrical measuring instruments." F. STROUDE and E. JOSEPHS. July 17th.

16,488. "Terminal and like boxes for use with conduits or casings for electric conductors." A. E. WOODHOUSE. July 18th.

16,489. "Conduits or casings for electric conductors." A. E. WOODHOUSE. July 18th.

16,498. "Electrical conducting cables and the like." M. D. DAVIS. July 18th.

16,514. "Electrical terminals." A. P. LUNDBERG, G. C. LUNDBERG and P. A. LUNDBERG. July 18th. (Complete.)

16,523. "Portable field telephoning apparatus." C. M. M. DARE. July 18th.

16,532. "Electric lifts." W. H. SCOTT. July 18th.

16,542. "Covering of electric conductors with plastic material and apparatus therefor." W. S. SMITH and A. D. SHUTER. July 18th. (Complete.)

16,547. "Electric fuses or cut-outs." C. W. DENNY. July 18th.

16,553. "Apparatus for recording telephone calls." C. C. CHAPMAN and A. GRIMSLEY. July 18th.

16,554. "Manufacture of electrical condensers and similar apparatus." J. A. L. DEARLOVE and S. G. BROWN. July 18th.

16,584. "Electrical combined switch and fuses." R. ADAMS. July 19th.

16,602. "Device for heating running water or other liquid by electricity." H. LOVQUIST. July 19th. (Complete.)

16,636. "Production of long stable electric arcs for the treatment of gases." J. Y. JOHNSON. (Badische Anilin and Soda Fabrik, Germany.) July 19th.

16,644. "Electro-mechanical change-speed and reversing device." P. GARNIER. (Convention date, July 19th, 1910, France.) July 19th. (Complete.)

16,667. "Method of controlling and operating electric locomotives, electric trains, electric tramcars and other electric traction machinery." A. MARTIN and A. J. CAMPBELL. July 20th.

16,678. "Electric arc lamps." ENGINEERING AND ARC LAMPS, LTD., and A. T. DOWDELL. July 20th.

16,679. "Electric arc lamps." ENGINEERING AND ARC LAMPS, LTD., and A. T. DOWDELL. July 20th.

16,694. "Insulating supports for electric conductors." J. J. KINLEYSIDE. July 20th.

16,707. "Telephone and other suitable sound receivers." C. KAHN (trading as E. C. Rein & Son). July 29th.

16,721. "Transmitting telegraph keys." E. E. MOORE. July 20th.

16,737. "Compensation of polyphase commutating dynamo-electric machines." BRITISH THOMSON-HOUSTON Co., LTD. (Allgemeine Elektricitäts Ges., Germany.) July 20th.

16,738. "Regulating devices for the driving motors of spinning machines." BRITISH THOMSON-HOUSTON Co., LTD. (Allgemeine Electricitäts Ges., Germany.) July 20th.

16,796. "Means for connecting electric cables to junction, bifurcating, trifurcating terminal boxes and the like." G. W. HUMPHREYS. July 21st.

16,828. "Terminals for ignition plugs." G. H. LONGFORD and W. R. CLARK (trading as Sphinx Manufacturing Co.). July 22nd.

16,841. "Regulators for dynamo-electric machines." A. H. RAILING and A. J. D. KRAUSE. July 22nd.

16,859. "Electrical secondary or storage batteries." C. BAYER and A. HUBBARD. July 22nd.

16,867. "Automatic telephone exchange selector." F. R. MCBERTY. (Convention date, July 23rd, 1910, United States.) July 22nd. (Complete.)

16,868. "Wiring contacts of telephone switches." WESTERN ELECTRIC Co., LTD. (Western Electric Co., United States.) July 22nd. (Complete.)

16,869. "Semi-automatic telephone systems." F. R. MCBERTY. (Convention date, July 23rd, 1910, United States.) July 22nd. (Complete.)

16,870. "Drum type controllers for the shunt control of electric motors." A. WEST & Co., LTD., and W. J. MOGGRIDGE. July 22nd. (Complete.)

16,871. "Liquid electric controllers." A. WEST & Co., LTD., and W. J. MOGGRIDGE. July 22nd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

VOLTAGE REGULATION OF DYNAMO-ELECTRIC ALTERNATING CURRENT MACHINERY. Akt.-Ges. Brown, Boveri et Cie. 15,415. June 27th. (July 10th, 1909.)

AUTOMATIC ELECTRIC RECORDING DEVICES. A. Lambot. 15,619. June 29th.

ELECTRICALLY CONTROLLED EJECTOR VACUUM CLEANING APPARATUS. T. H. White. 15,695. June 30th.

COUPLINGS FOR ELECTRIC ARC LAMPS. J. E. F. C. Pechin. 15,789. July 1st.

ELECTRIC TRANSMISSION MEANS FOR USE AS OR IN HELM INDICATORS OR IN TELEMOTOR ARRANGEMENTS FOR STEERING GEAR AND THE LIKE. Clarke, Chapman & Co. and H. J. Moysey. 16,559. July 11th.

STRETCHER OR GAUGE BARS FOR RAILWAY SWITCHES. A. H. Johnson and L. W. Williams. 16,800. July 14th.

ELECTRICAL SWITCHES. Electric and Ordnance Accessories Co. and N. Collins. 19,182. August 16th. (Addition to 24,373/1909.)

ELECTRIC CONTACT BREAKERS FOR USE IN CONNECTION WITH THE IGNITION SYSTEMS OF INTERNAL COMBUSTION ENGINES. B. Brooks and F. H. Alston. 19,535. August 20st.

ELECTRIC FURNACES AND THE MANUFACTURE OF STEEL. G. Massip. 22,777. October 1st. (October 2nd, 1909.)

ELECTRIC HEATING APPARATUS. H. Hirst and C. H. Archer. 24,238. October 19th.

MAGNETO ELECTRIC CURRENT GENERATORS. P. A. Juston and R. Bunzli. 28,177. December 3rd. (March 10th, 1910.)

ELECTRIC LIGHTING. I. Frankenburg & Sons, Ltd., and E. Fleming. 28,734. December 10th.

TUNGSTEN AND THE MANUFACTURE THEREOF. British Thomson-Houston Co. (General Electric Co.) 8,031. April 2nd.

ELECTRICAL TIME SWITCHES. W. Hamilton and Ferranti, Ltd. 13,704. June 6th.

WIRELESS OPERATED ELECTRICAL SIGNALLING, INDICATING OR LIKE MEANS. L. Cerebotani. 16,360. July 8th.

TROLLEY POLES FOR ELECTRIC TRAMWAYS. R. Ashworth. 17,690. July 6th.

ELECTRICAL HEATERS OR STOVES OF THE RADIATOR KIND. Veritys, Ltd., and W. G. Pipkin. 18,186. July 30th.

AUTOMATIC MEANS FOR RAISING AND LOWERING ARC LAMPS OR OTHER FITTINGS SUSPENDED IN CENTRAL CARRIER FRAMES. J. Stevenson and O. R. Williams. 18,217. August 2nd.

SPEED REGULATION OF INDUCTION MOTORS. Milch. 22,717. (October 1st, 1909. Addition to 12,326/08.)

DEVICE FOR PROTECTING THE EARS AND TROLLEY WIRE ON ELECTRIC RAILWAYS AND TRAMWAYS. H. M. P. Dudgeon. 23,536. October 11th. (Cognate application No. 26,462/10.)

SELF-REGULATING ARC LAMPS FOR PROJECTION. A. Schmidt. 25,634. November 4th.

ELECTRIC HEATERS. M. B. Field and Ferranti, Ltd. 26,836. November 18th.

1911.

REFLUX CONDENSERS. C. Still. 3,269. February 8th.

ENCLOSED ARC LAMPS. Korting and Mathiesen Akt.-Ges. 3,891. February 16th. (February 21st, 1910.)

ELECTRICITY MOTOR METERS. Chamberlain & Hookham, Ltd., and S. James. 10,816. May 4th.

Barcelona Electrical Trade.—According to the French Consul at Barcelona, the import trade in electric apparatus in this city and the adjacent districts is mainly in the hands of German firms, the imports from Germany in 1909 attaining a total of 1,351,541 kg., as against France's contribution of 2,146 kg. The Allgemeine Elektricitäts Gesellschaft, of Berlin, is the principal importer. The Compania Barcelonesa de Electricidad is only an independent offshoot of this firm. The Spanish manufacturing company recently started, called La Industria Electrica, which turned out dynamos, cables and a lamp styled the Z lamp, is likely to be absorbed shortly by the German company, negotiations to this end being already on foot.—*Revue Pratique de l'Electricité.*